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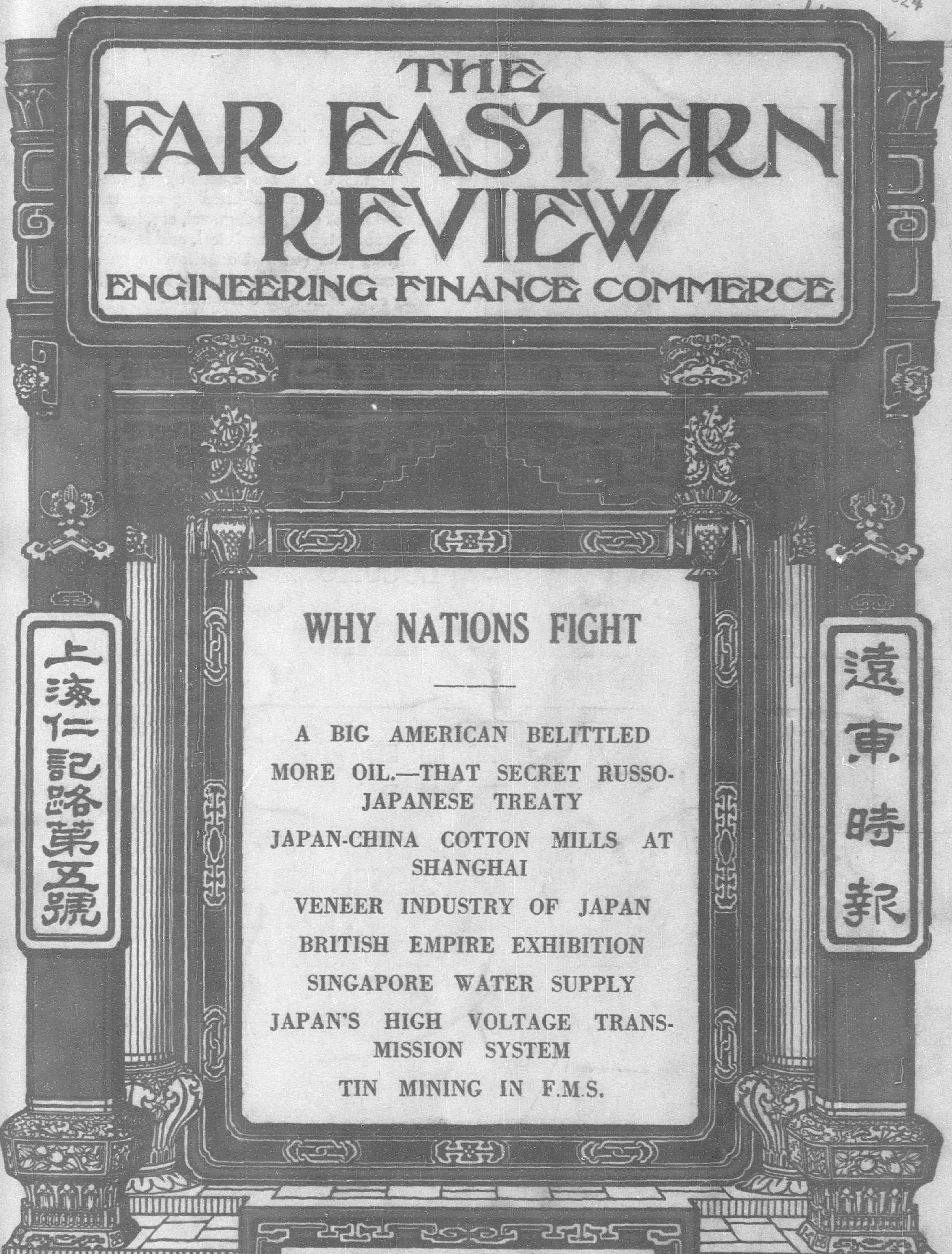

THE FAR EASTERN REVIEW

ENGINEERING FINANCE COMMERCE

遠東時報

上海仁記路第五號

WHY NATIONS FIGHT

A BIG AMERICAN BELITTLED

MORE OIL.—THAT SECRET RUSSO-JAPANESE TREATY

JAPAN-CHINA COTTON MILLS AT SHANGHAI

VENEER INDUSTRY OF JAPAN

BRITISH EMPIRE EXHIBITION

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JAPAN'S HIGH VOLTAGE TRANSMISSION SYSTEM

TIN MINING IN F.M.S.

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SHANGHAI, PEKING, TOKYO AND MANILA

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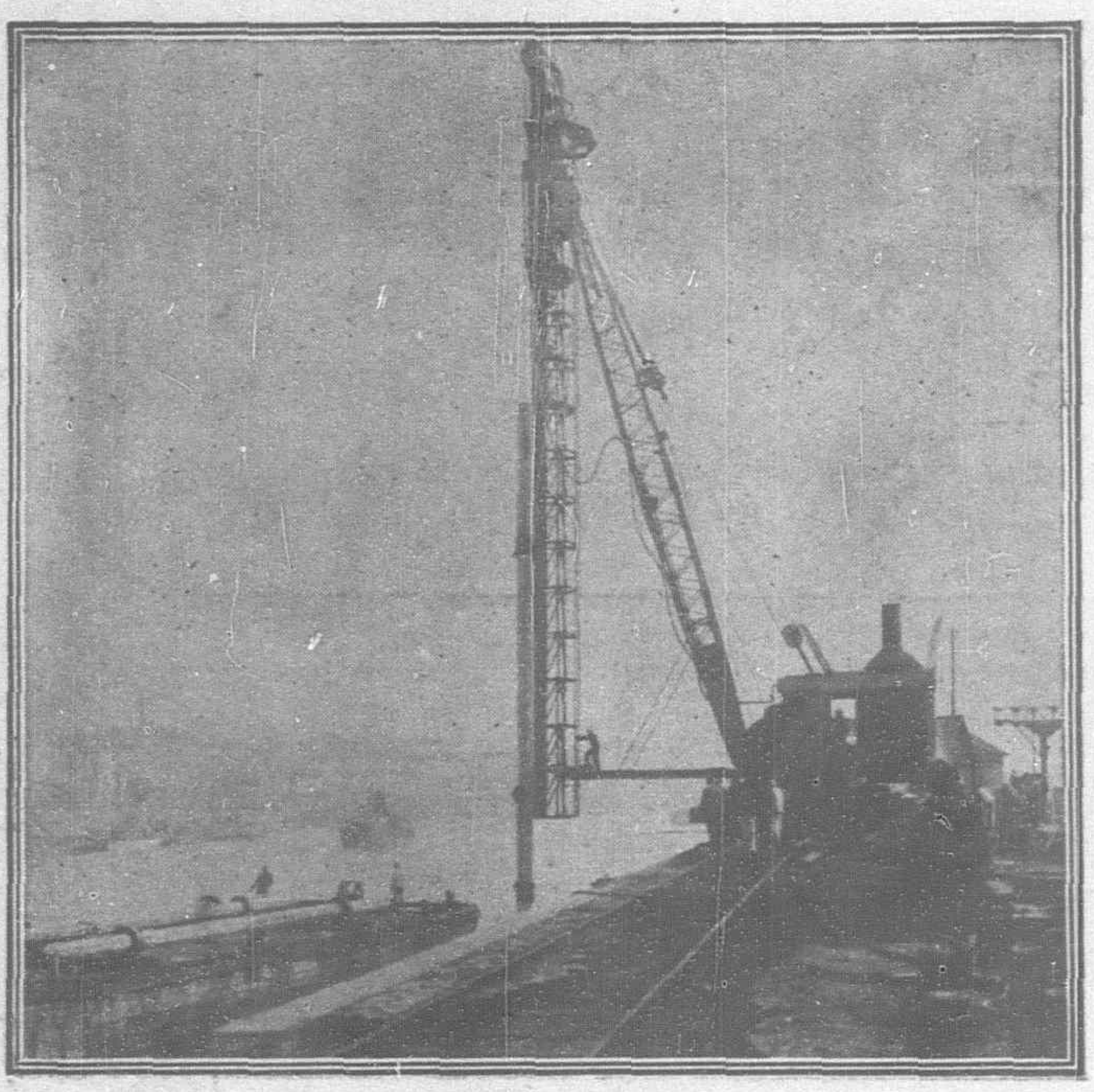

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The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XX SHANGHAI, AUGUST, 1924 No. 8

Why Nations Fight

The Ringed Fence Around Japan

THERE was a time ten or more years ago when the utterances of Japanese jingoes fully justified the United States in preparing for trouble. Conditions have changed since then and it is now the highly placed strategists in the United States who give vent to bellicose thoughts. Last year about this time two ranking officers of the American navy attending the annual conference of the institute of politics at Williamstown, urged a huge appropriation for the navy on the hypothesis that some foreign power might discriminate against our rights to equal opportunity in the trade of China, and it came out in the debate that the hypothetical enemy was Japan. A month ago, or immediately after the president signed the immigration law, Rear-Admiral Bradley A. Fiske, another of our foremost and most capable strategists, threw another jolt into the American people by pointing to the peril of a war with Japan because diplomatic relations had become strained between the two countries, by the recall of Ambassador Hanihara. "Such attitudes and such acts have usually preceded wars, although they have not always been followed by wars," said the admiral, and then went on to explain why, under these conditions, the navy should be strengthened. There were many excellent reasons why the navy should be brought up to its full strength under the 5-5-3 ratio without lugging in Japen, the weakest of the three great naval powers under the disarmament treaty, but in our country every time an increased army and navy appropriation is deemed essential by our strategists, some specific enemy must be used in order to get the required public approval. Unfortunately, the hypothetical enemy is always Japan. Now comes Major General James G. Harbord, one of our greatest living military leaders and in order to put over his plea for military preparedness, picks Japan as the possible enemy. General Harbord, however, is more conservative than his naval colleagues and presents his facts in a more convincing manner. He takes the stand that only in America can the Asiatic find an outlet for his surplus millions and such being the case, believes a rich and powerful nation must always be alert to protect itself from impoverished and embittered peoples. He goes on to say :

> "The most striking fact of the world to-day is the very uneven division of the earth among the sixty odd nations that occupy the entire land area of the globe. At one extreme, we have the 60,000,000 Japanese occupying the islands of Japan with a total arable land smaller than the area of Ireland and at the other extreme, 65,000,000 white people in the whole British empire, occupying 7,000,000 square miles and ruling another 7,000,000 square miles.
>
> "Or again, including Korea and Formosa, the entire area under the Japanese empire is 260,000 square miles and the population over 77,000,000, while just across the Pacific, the United States and Canada, with more than seven and one-third million square miles, have a population of 115,000,000.
>
> "Thus there are nearly two-thirds as many people in the limited area of the Japanese empire as there are in the vast territory of the United States and Canada. Does it not seem inevitable that the peoples in North America must be prepared some day either to share their enormous possessions with the peoples of Asia or to defend them against forcible aggression ?
>
> "It is well to recognize the truth that the greatest conflicts may be between nations both of which are right. Certainly, nothing but incalculable harm could come to the United States if the Japanese and the Chinese could enter the United States according to their needs. And it is just as true that the Japanese and Chinese are most unjustly deprived of their rights to a more equal share of the earth's surface.
>
> "Both sides are right. Force will determine which right shall prevail."

In other words, might is right. Looking at the problem from General Harbord's viewpoint his conclusions are eminently fair. In fact, it is the first time a high American authority has even suggested that Japan might have some right on her side. We do not, however, believe in the inevitability that the peoples of North America must prepare to defend their homelands against Asiatic aggression. Ten years ago, we supported the ideas expressed by General Harbord as a purely preparedness argument but now believe that the real solution of the racial problem lies in Asia, and if American policies were adjusted to bring this about, an end would come to all this talk about a possible war with Japan.

If Russia is permitted to absorb all the available population outlets in Asia and exclude the Mongolian race from the lands stolen from them, the resultant pressure will force the Mongolian surplus across the seas. The real menace, therefore, to the security of the United States is not Japan but the growth of Russia to a point where she will dominate Eastern Asia and again close her doors to Chinese and Japanese capital and labor. This will certainly lead to a show-down between Japan and Russia or force the racial issue out into the Pacific for Americans to settle. If Americans would only see through this nice little scheme to make them fight Japan and wake up in time by remodeling their Far Eastern policies, the program might be changed. If, instead of hampering and hamstringing Japan every time she has the diplomatic advantage in the struggle that will open to her people the lands of Eastern Asia, America would encourage her in this direction, there will no need to spend annually millions for preparation against a possible aggression on the part of Japan. A policy which deliberately invites and prepares for a war in the Pacific when the issue should be fought in Asia, is to say the least, assinine.

Russia Absorbing China's Possessions

Let us look at the picture painted by *The Central China Post.* In commenting on the large postal map of China eight feet by six in dimensions affixed to the blank wall in the editorial sanctum it says that while one-third of the map (representing 1,500,000 square miles) is packed so closely with place names that it would be hard to find room for another, the remaining two-thirds of the area of the map (representing 2,850,000 square miles) are staringly empty. The one-third is China proper and the two-thirds is China's possessions in which China can hardly be said to be in possession. Mr. Archibald then goes on to point out that Mongolia with 1,370,000 square miles (nearly as large as China proper) is a Soviet republic in which the real power is all held in Bolshevist hands. Red troops are still in the country and although China has protested again and again there is no sign of any change being made in the situation.

Then, he adds, there is Sinkiang, or Chinese Turkestan, in which Chinese officials are functioning but Russian settlers are pouring in in large numbers. "What is to be done with this Russian invasion is still unclear," but he believes it will end in another declaration of independence and the formation of another Soviet republic under the protection of Russia. "Soviet Russia," he declares, "is quite as aggressive as ever Imperialist Russi awas. It is equally keen on expansion, although the methods by which it contrives to reach its end are different." Lastly, he invites attention to the situation in Tibet in which Great Britain is mixed up. It was the coquetting of Russia with Tibet that led to the Younghusband expedition to Lhassa in 1904 and the signing of treaties which eliminated China's shadowy hold over that country. To-day, China has nothing to say in the administration of Tibet." Since Mr. Archibald wrote the above, the Chinese provincial government of Sinkiang has entered into an independent trade treaty with the Soviet. The announcement that the treaty was sanctioned by Peking, is merely a face-saving statement to conceal the impotence of the recognized Chinese government.

Where will Italy Expand

Let us now turn to another picture. *The Christian Science Monitor* of June 30 asks " where will Italy expand ? It then goes on to depict a very pathetic picture of the dilemma with which the Italian nation is faced through the pressure of population. Emigration to America has in the past relieved this pressure but with this outlet stopped by the recent immigration laws, where will the Italian worker turn ? *The Monitor* points out that as in Germany before the world war, the Italian government seeks to find an outlet for the excess population that will not lose for the mother-country the political allegiance of the departing children. About the only place where this can be done is in northern Africa where great areas that supported a large population at the beginning of the Christian era have been allowed to deteriorate by the nomadic Arabs. But here they will come in conflict with the imperialism of France who has not the colonists to develop her African possessions. The Italians have. So, *The Monitor* believes, that " the European equilibrium will be benefitted by an Italian mass emigration to the southward. More history will be made there in our own times."

Here is a great imperialistic republic reaching out and constantly adding to its African empire, when it has no colonists to develop its resources. Every Frenchman who goes to the colonies leaves a void in the economic life of the homeland which in the past has been filled by the Germans, the Italians, the Poles or other Europeans. We see here a problem almost identical with the one confronting Japan, with the difference that aside from the quota bar in America the waste spaces of the world are open to the Italian. France controls a colonial empire in Africa, which, if developed at all, will probably be done with Italian labor, a possibility that is now brought within the realms of reality by the operation of the American law which closes the door to an annual overflow of 300,000. If the trend of emigration throws these Italians into Northern Africa and the mother country insists on holding their political allegiance, what will be the outcome ? We hear no condemnation of Italy because she seeks an outlet which means in its last analysis the acquisition of territory by peaceful penetration or open conquest at the expense of some other nation.

Forcing Japan to Fight

Keeping these pictures in mind let us return to the argument of General Harbord and ask : why should Japan seek an outlet for her surplus millions four thousand miles across the Pacific when there is ample room for them nearer at home in the waste places of Eastern Asia ? Why should it be inevitable that the peoples of North America must be prepared some day either to share their possessions with the peoples of Asia or to defend them against forcible aggression, when there are nearly 3,000,000 square miles of waste territory open for settlement within the confines of China and probably an equal area in Siberia? Why then should it not be inevitable that China and Japan should overflow into the vacant lands within their own habitat where there are as many opportunities for profitable development as in America ? Why should Americans always see in Japan's pacific efforts to obtain an outlet for her people a menace to their own security, when they deliberately close their eyes to the land-grabbing program of Russia which slowly but surely is absorbing the outlying possessions of China and the vacant spaces of Central Asia, building a wall around the Yellow Man and forcing him over the seas to seek his future ?

Why should not the policy of the United States undergo a radical change and, instead of picking on Japan, be directed towards checking Russia's expansion in order that China and Japan can find a peaceful solution to the racial problem by opening to them an outlet within the lands that God, nature and geography intended should be theirs ? Why should not the American government formulate a new outlook on Asiatic affairs in which the cardinal principle would be to encourage Japanese development of Eastern Asia, so that the racial question, if it ever has to be faced, will not be shouldered on to its own people ? There is absolutely no reason for America to prepare against the possibility of Japanese aggression in order that they may enter our country. There is every reason on the other hand why we should arm and be always prepared to fight if our present policy is perpetuated. If we close our doors against the Japanese ; teach other peoples how it can be done ; then follow them up in Asia and bar them out of the Philippines, standing between them and expansion to the south ; if we build a ringed fence around them in Manchuria and constitute ourselves the protector of China, the savior of Russia and the police of Central Asia and concentrate our diplomacy on handicapping their legitimate aspirations in Mongolia, Siberia and Saghalien ; we must prepare to fight Japan some day. Even a yellow cur will fight when driven into a corner. And Japan is not a yellow cur.

Stake by stake the ringed fence around Japan has been erected. It only remains to string the barbed wire entanglements. There was just one outlet, which looked out upon the vast plains of Manchuria and Mongolia. The cloud no bigger than a man's hand, however, has now appeared on this horizon. News dispatches from Mukden report that Marshal Chang Tso-lin, overlord of Manchuria, has issued an order prohibiting aliens from leasing land within his jurisdiction for agricultural purposes. It would look as though he had taken a leaf from the book of California or employed an American from that state as his adviser. If that order is carried out ; if the one outlet for Japan's millions is closed, if Japan is to be the one nation in the world to be fenced in, penalized and denied the right to emigrate, we heartily concur with our strategists that we must keep our military and naval establishments up the highest point of perfection and preparedness. No government in Japan, no matter how pacific, how liberal or how friendly, would be able to withstand this challenge to the right of its people to exist.

* * *

American Money for Japanese Development

The Success of the Daido Loan

THE success attending the flotation of the first installment of the Daido Electric Company's loan in New York is convincing evidence of the friendly feeling of the American people towards Japan. Within a few hours, the issue of $15,000,000 was oversubscribed, twice the sum required being offered, and the outstanding feature was the applications for $3,000,000 by California investors. The total amount of the loan is $30,000,000 secured by a first mortgage on the extensive properties of the Daido Electric Power Company and which will be the basis for electrical equipment orders to that amount.

Momosuke Fukuzawa, head of the Daido electric power interests, has been in personal charge of the negotiations assisted by Messrs. Thebo and Anderton of the San Francisco engineering firm of Thebo, Starr & Anderton.

The decision to seek a loan in the United States followed two or more years of thorough study of Japanese hydro-electric development possibilities. As a result of this the Daido company has already built five large power stations on one river and plans to electrify another to supply more adequately the cities of Tokio, Kobe, Osaka and other population centres. The possibilities in this connection are of great economic importance to Japanese industrial and domestic consumers.

The fact that Japan is one of America's most rapidly growing customers for electrical equipment and apparatus and is now buying from American concerns at the rate of $10,000,000 or more a year has been a strong factor in the successful flotation of the loan. The fact that such large American concerns as the General Electric and Westinghouse companies will supply a large part of the central station, generating and other equipment covered by the proposed loan, is another consideration which made the issue popular.

The Japanese government has taken no part in the negotiations ; it being a purely private undertaking on the part of the bankers who had a representative in Japan for the purpose of studying the proposed hydro-electric developments and whose report was favorable.

Only half of the full amount of the mortgage credit has been made immediately available, the rest of the loan to be extended, as the orders for the needed electrical equipment require. The flotation of 50 per cent. of the loan at this time has behind it the fact, also, that the American money market, with its prevailing low rates, is extremely favorable to financing through the sale of bonds. Messrs. Dilton, Read & Co. will have charge of the flotation.

Because it has been the policy of the Fukuzawa interests to divide their electrical orders among the large American companies, another company which is expected to share in the future orders for the projects planned is William Cramp & Sons, ship and engine builders. This company supplies, besides nautical equipment, water wheels for industrial and hydroelectric plants.

The Hakata Harbor Contract

The next important Japanese proposition to be placed before American financiers will be the scheme for constructing a new harbor at Hakata in the island of Kyushu, where the Asia Development Company (an American enterprise whose head office is in Shanghai) has signed an agreement to build a harbor, docks, breakwater and a two-mile tunnel to connect with the town of Fukuoka on the main railway line between Moji and Nagasaki. The entire contract will approximate Y.11,000,000. The tunnel is intended to tap the many coal fields in the vicinity, the richest in Japan, having a combined output of 2,000,000 tons of coal annually. It is expected that with the completion of the harbor and the tunnel Hakata will become one of the most active ports of Japan taking away much of the coal traffic which now passes through Moji and Nagasaki. The harbor construction plans have been drawn by Dr. Kawakami an authority on harbor works and on the completion of the contract the harbor will accommodate thirteen steamers of 10,000 tons each at one time. The Hakata people are also contemplating raising the further sum of Y.80,000,000 in the future for the reclamation of a harbor area three times as large as the present size of the city and erect a large iron foundry and other industrial plants.

* * *

Mints and Arsenals

Governor Yen of Shansi on the War Path

(Contributed)

VARIOUS items of news from foreign and Chinese sources which have recently come to hand in Peking have appeared to indicate the possibility of a change of policy in the so-called model province of Shansi, a result which would be the more regrettable in that up-to-date Governor Yen has successfully endeavored to keep his jurisdiction aloof from those military plots and civil wars which are devastating the rest of China. The first indications of a change in his attitude were evinced last year over the vexed question of suppression of opium, for Governor Yen took the most stringent steps to prevent the drug passing through his territories in any direction, an act which undoubtedly alienated many of the militarists who base their present fortunes upon a systematic and judicious cultivation of the poppy in the areas under their control. It is quite possible that Governor Yen himself foresaw what the result of his actions would be, for the powder plant supplied some time ago to his arsenal can hardly be explained on any other basis, while his most recent action in calling for material suitable for the manufacture of light field artillery and bomb throwers would be but an extension of his new policy of "forewarned is forearmed." A foreign observer recently returned from the province reported to the effect that experiments in mining had also been carried out a short time ago, the Chinese stating that field mines had been laid along the approaches from the Peking Hankow Railway at Shihchiachwang towards Taiyuanfu. Taken in conjunction with certain enquiries as to the construction of machine gun "pillboxes" and their suitable sitting on hillcrests so as to command mountain passes there seemed to be sufficient material to warrant further investigation, for a decided change in the attitude of the province of Shansi towards the Chihli party would be of the utmost importance under the present uncertain political circumstances.

At first glance everything in the model province seemed quiet and peaceful. The little narrow gauge railway which connects Taiyuanfu with the main line appeared to be running in perfect order, the inspectors who enquire as to one's identity and keep a keen eye for opium smugglers were on the job as usual, and although many soldiers were to be seen at the railway stations *en route* they did not venture to invade the first-class carriages as is their custom on the remainder of the Chinese railway system. The rolling stock was in pretty fair order, the stations too were clean and plastered over with placards threatening dire punishment to any who were caught smuggling opium, pronouncements which the past twelvemonth has shown to be no idle boast, for opium smuggling has indeed been put down with a strong hand throughout the province. When one reaches Taiyuanfu itself the city seems to be wending its usual quiet and prosperous way, and it is not for some hours that it becomes apparent to the observer that there are indeed more soldiers than formerly passing to and fro in the busy streets, and that the people themselves have an air of strain and suppressed excitement as if important events were in the shaping. A rough estimate would place the troops in the capital alone at some ten thousand rifles, a large proportion of the provincial army if it is still maintained at its old standard of eighteen or twenty thousand for the whole province. That these numbers have been considerably increased seems no more than probable however, for further investigation shows that the arsenal is working full time turning out munitions of war, while several representatives of foreign firms are to be noticed in the city, doubtless tendering for the supply of machinery to the provincial mint. For this is the name under which munitions of war masquerade in China to-day, and Taiyuanfu is no exception to the rule. After all, if Governor Liu Chen-hua of Shensi can call for tenders on the specifications of a mint that turns out cartridges and rifles as well as dollars why should not Governor Yen Hsi-shan employ a similar device if only in self-defence. British and American firms will naturally insist on supplying material solely for minting purposes, having regard to the arms embargo but manufacturers and importers of other European nations are hardly likely to be so particular, wherefore there can be little doubt that the governors of Shensi and Shansi alike will obtain any and every kind of plant for "minting" which they may happen to desire.

As far as can be ascertained the output of the arsenal (we mean of course mint) is limited to ammunition and rifles, though some say that machine-gun parts are also manufactured, but at any rate there is no doubt that output of some kind is being pushed forward as rapidly as possible. The head of the gunpowder department of the "mint" is a doctor of chemistry graduated from Switzerland, while the other departments for the manufacture of lethal "finance" are under a German engineer. The latter chanced to be out of town at the moment, and it is commonly reported that he has resigned and will be leaving shortly on account of a difference of opinion as to the possibilities of the plant in manufacturing artillery. The Chinese are relating a story anent this which seems almost too crazy to be true if one does not know China and realize that anything may happen here under present conditions. It seems that governor Yen desired to purchase some light artillery and bomb throwers, and having discovered the impossibility of obtaining them from abroad decided to manufacture them at Taiyuanfu in his own arsenal. That the plant is not suitably equipped for such work made little difference, the fiat had gone forth, and the materials were to be tendered for. One would naturally imagine that chrome-nickel steel would be specified and supplied, but in thus estimating one would be failing to allow for the vagaries of the Chinese mind. Of course the story as related in Taiyuanfu may be a myth, but it is asseverated there that one firm tendered for supply of wrought iron for the bomb throwers (we mean of course "minting" machinery, how one's typewriter is apt to run away with one) and that their proposal was more than favorably considered. Ordinarily, one would classify this story as the result of too many whisky sodas, but in this case where there is smoke there is fire, and the fact remains that half a dozen representatives of various firms were perambulating around the city, discussing business with certain officials and in general behaving as if they were not in Taiyuanfu for their health alone. To this story is linked up the resignation of the engineer to the arsenal—mint, the only statement which is susceptible of immediate proof, but here again, of course, one cannot definitely state that his retirement may not have been due to entirely different reasons or difficulties and disputes arising prior to this last ebullition of Chinese fancy.

If one declines to accept all these stories at their full face value and merely regards them as a proof of military activities in certain directions, the which are undoubtedly taking place, the next question of interest is the why and wherefore of it all. What has possessed Governor Yen Hsi-shan to abandon his customary and apparently very successful policy of peaceful occupation and adopt instead the attitude of a *tuchun* who bases his power on the mailed fist and the rattling of the sword.

The answer is simple! Governor Yen likes his job and his province, having successfully held them ever since the first days of the revolution, and he has not the slightest intention of parting with them now if he can help it. On the other hand, ever since the establishment of the Tsao Kun administration, plot after plot has been set on foot by some militarist or politician who desired the post of governor of Shansi for himself or some relative. These endeavors, if they have not received the open support of the president, have at least not been frowned upon by him, partly on account of the indifference displayed by Governor Yen during the recent struggle for the presidency and partly from the unfortunate necessity of finding suitable posts for certain of Wu Pei-fu's followers, while it is also stated that the anti-opium campaign so ably maintained by the model governor is extremely distasteful to His Excellency Tsao Kun and his friends. Up-to-date Shansi has managed to retain Yen in his post by the payment of a monthly sum of $10,000 to the war-chest of the Chihli party, but recently a demand was addressed by them calling for an increase from $10,000 to $20,000 per month, with the alternative of the replacement of Governor Yen Hsi-shan by some other nominee who would be more amenable, or shall we say less scrupulous in draining the resources of the unlucky province. This ultimatum has hardly had the result desired apparently, for governor Yen seems to have decided to hold his job *manu militari*, and therefore to have suspended all payments whatever, at the same time pushing forward all possible military preparations. It must be admitted that war material ex Taiyuanfu arsenal is not a very deadly threat, to the enemy at any rate, but when taken in conjunction with the natural advantages possessed by the province it would appear to be more than the Chihli party or its nominee for the post may care to tackle at the moment. Shansi is more or less economically self-supporting, while it is bounded on the west by the Yellow river and on the north by ranges of unpopulated hills where both lack of water and lack of supplies would render a campaign extremely difficult if not impossible. The only real avenue of approach is via the narrow gauge railway, and the passes *en route*, as the writer observed to Governor Yen's chief of staff some eighteen months ago, are easily defendable and if held render the railway useless for an invading force. Of course all intercourse with Peking and the south would be severed at the junction of the Peking-Hankow Railway at Shihchiachwang, but that would not be a matter of vital importance to Shansi merchants for a few months, and it is very doubtful if a blockade of this nature could be maintained for any lengthy period of time. All in all it would seem that Governor Yen has taken the best way of dealing with a difficult situation, and in view of the fact that his province is by far the best administration in China at the present time it is to be hoped that any overt threat on the part of the militarists will recoil upon themselves, as undoubtedly it will if only the people of the province of Shansi stand firmly behind their nominee, at the same time enlisting on their behalf all the support which liberal and democratic opinion in China can give.

A Big American Belittled

Sidelights on the Campaign to Kill an American Loan to Japan

An Appreciation of Cyrus E. Woods

DURING the great war the United States was represented in China by a diplomat who in order to force Peking into the conflict on the side of the allies compromised his government to a definite policy at the peace conference and when the force of circumstances compelled President Wilson to accept a different solution, the American minister promptly tendered his resignation in a letter calling for a "show-down" with Japan and entered the service of the Chinese government as its High Adviser. During his tenure of office, Dr. Reinsch built up an organization whose propaganda has done more to sow the seeds of ill-will and future wars than all other influences combined. To this group, Dr. Reinsch was a man who could do no wrong; his resignation and acceptance of a post under the Chinese government exemplified the highest type of moral courage, the act of a super-patriot. This organization still exits, and loses no opportunity to throw mud at Japan and belittle any American who has a good word to say for that country or its people. It is admitted by many American diplomats that it will take many years to undo the mistakes of Dr. Reinsch. When the present administration came into power the war clouds hung very low over the Pacific. It required diplomacy of the highest order to avert a disaster. Ambassador Warren had a difficult task in Tokyo paving the way for Secretary Hughes to clear the atmosphere through the Washington conference. After Warren, came Cyrus E. Woods determined to supplement the good work of his predecessor by drawing the two nations more closely together in the bonds of commercial co-operation. Woods did his work nobly and well and when the earthquake and fire bowed the Japanese in profound sorrow, he won their eternal gratitude by the manly, frank and open-hearted manner in which he strove to turn the calamity into a blessing. He was the right man in the right place, an honor to his country, and to its traditions. When the senate passed the immigration act with its Japanese exclusion clause, the usefullness of Ambassador Woods came to an end. He made a speech deploring the hasty action of the senate and sent in his resignation. Every newspaper in the United States which has commented editorially on his resignation, commends his action.

"It is no secret" says the *Philadelphia Evening Public Ledger*, "that Ambassador Woods is returning home after a hopeless but gallant fight to preserve American dignity and honor." *The Richmond Times-Dispatch* says there was nothing else for him to do." Woods, knowing the Japanese aims and Japanese character better than any congressman possibly could know them, knew congress was wrong. He said so publicly. And the thinking people of the country know congress was wrong." *The Bridgeport Telegram* says that "the slap in the face which the United States senate gave to Japan could not but have the effect of nullifying his efforts." *The Auburn Citizen* says that "the old theory prevails that, if the home government adopts a policy contrary to the advice of the diplomatic agent and which in his estimation endangers its good relation with the government to which he is accredited, he has failed in his mission and lost his usefullness. It is quire understandable that Mr. Woods feels this to be true in his case." *The Brooklyn Citizen* says that Ambassador Woods has taken the only course an honorable man could take when he resigned his post as a protest against the adoption by congress of the bill excluding Japanese immigration." *The Chicago Post* says that the "sort of diplomacy which seeks to promote good feeling has been rebuffed." *The Columbus Journal* commenting on the frequent change in ambassadors says "in the present strained situation it can be considered only as deplorable that a new man must be sent to the important post in Japan." *The Reading Tribune* prints an editorial supplied to many newspapers by a special service which says: "expressions of regret come from editors all over the country who feel that Ambassador Woods has rendered notable service in the Orient and that his influence would mean much toward preventing a rupture of friendly relations between the American and Japanese people if he would remain in Tokyo." *The New York Evening Post* suggests that "those who realize how earnestly Ambassador Woods has labored, how much he had accomplished and what high hopes were his, will note that two weeks before May 1 the senate of the United States had destroyed much that he, his predevessors and a generous nation had done through many years." Another editorial which appears in many Middle-western papers, says: "Some Americans may sneer at the friendly feeling in Japan for Ambassador Woods, and say that he was too considerate of Japanese interests. Yet perhaps the most serviceable envoy to another country is a man who can understand and sympathize with that country's viewpoint and, instead of antagonizing it, try to make his fellow-countrymen understand it and labor for a friendly compromise.

We might go on quoting American editorial opinion commending Ambassador Woods ; we might reproduce the words of President Coolidge praising his work in Japan, but we merely emphasize that not one American editor has suggested that his resignation was anything but spontaneous on his part. It remained for the editor of the so-called American newspapers in Shanghai to circulate the innuendo that the resignation of Ambassador Woods was asked for by his government. In gazing out of the East Window of *The China Press* on July 20 its editor gathered from the ether the following thoughts on the reasons for the retirement of Ambassador Woods :

> " Immediately after the passage of the U. S. immigration law restricting the migration of Japanese coolie laborers and agriculturalists to the United States, the American Ambassador got up and made a speech before a Japanese audience. Instead of explaining to his Japanese listeners just what the new law meant and how it represented the culmination of efforts extending over nearly a half century on the part of the American Government to limit immigration, the American ambassador made a rather violent speech attacking congress for its action. He resigned a few days after this oratorical effort—the announced reason being that he was forced to return home on account of the illness of his mother-in-law."

If the editor of *The China Press* had cabled to anyone of his fellow alumni in Tokyo they would have told him that the public announcement of the resignation of Ambassador Woods was held back for over two weeks, during which time secretary Hughes was almost peremptory in requesting Mr. Woods to reconsider his decision. Mr. Woods did his best to comply with the urgent commands of the secretary of state and subordinate personal feelings to duty. It was, however, impossible for any self-respecting diplomat to remain on a job after his own government had destroyed his usefullness, so reluctantly and with a heavy heart he insisted upon resigning.

The China Weekly Review, is edited by the editor of *The China Press*, and in its issue of June 21, devotes a column to the retirement of Ambassador Woods. It says :

> " In view of the fulsomeness of the entertainment and farewell functions and messages of friendship and esteem which were heaped upon U. S. Ambassador Cyrus Woods by the Japanese organizations and the Japanese press prior to his departure for America recently we can't help but agree with the Japan *Chronicle* that " it is time for Mr. Cyrus Woods to pray to be saved from his friends of the Japanese Press." Americans residing in China are supposed to be under a handicap in their ability to view impartially Japanese affairs affecting America, or China either for that matter, so with this disqualification we will try to consider the case of Mr. Woods. Mr. Woods was appointed American Ambassador to Japan following the retirement of Ambassador Warren. During the earthquake disaster Mr. Woods made a fine record not only for himself but for his country due to the enthusiasm with which he engaged in relief work in spite of serious personal and domestic troubles, one member of his family having been seriously injured. After the earthquake he returned to Washington, *presumably* to report to his government regarding the situation in Japan. While he was in Washington the newspapers published the accounts of the Japanese atrocities toward Koreans and Chinese during the earthquake excitement. After reading these reports Mr. Woods gave out an interview to the press condoning these reports and questioning their accuracy."

Right here it is well to state a fact, which we suspect the editor of the *China Weekly Review* is not entirely ignorant of. One of the motives which influenced Ambassador Woods to return to the United States so soon after the earthquake and about which there is no conjecture, was to accurately inform his government as to Japan's financial needs and resources in order that a reconstruction loan could be successfully floated on the American market. This visit was deemed essential in order that Mr. Woods could personally counteract the activities set in motion to prevent the flotation of such a loan. A very complete but utterly misleading report on Japan's financial condition had been prepared for transmission through official channels to Washington for the purpose of destroying any possibility of an American loan to Japan. This report bore all the ear-marks of having been inspired by someone intimately associated with the anti-Japanese element in China. Woods discovered a " nigger-in-the-wood pile and took no chances of having his work destroyed. He went to Washington, and there paved the way for the successful flotation of the loan which linked the two countries tightly together in bonds that are difficult to break. At all times his efforts were being opposed by a propaganda which seemed to have its origin in Shanghai. Press dispatches signed by Mr. J. B. Powell, correspondent of the Chicago Tribune Service at Shanghai openly denounced the loan as a menace to the open door doctrine and in other ways tried to antagonize Americans against lending money to Japan for reconstruction purposes. That Woods frustrated this little scheme to prevent an American-Japanese *rapprochement*, is sufficient reason for this anti-Japanese American to belittle him. Now let us follow the concluding remarks of the editor of *The China Weekly Review* :"

> " Upon his return to Japan, the question of the Immigration Law came up in congress and naturally Mr. Woods feared that the passage of the legislation including the Japanese exclusion clause might interfere with the friendly relations of Japan and the United States. This was all right and no one could blame him for this feeling, but he made the mistake of delivering a public speech in Tokyo in which he condemned congress for its attitude. A few days after a report of this address had been cabled home Mr. Woods announced his retirement as American Ambassador to Japan, giving the reason as anxiety regarding the health of his mother-in-law who had been injured in the earthquake. Whether Mr. Woods resigned or whether he was recalled we do not know, but his return to his home land has given occasion for the Japan *Chronicle* to comment upon an editorial reprinted in Japan from the New York *World* to the effect that there are two kinds of ambassadors, those who convey the desires of their home government to the countries to which they are accredited and those who convey to their home governments the dispositions of the countries to which they are accredited."

Again there is the doubt as to the reasons for Mr. Woods' retirement. There was, however, one little item of news connected with Ambassador Woods' tour of duty in the Far East which the editor of *The China Weekly Review* very carefully overlooked. Immediately after the return of Mr. Woods to Japan, he started on a visit to Manila to confer with Governor General Wood. There he was received as befitted his rank of ambassador and second highest American officer in the Far East. On his return to Japan he stopped one week in Shanghai at the leading hotel.

Had the British ambassador to the court of the Mikado honored Shanghai with his presence for one week, his nationals would have met him at the wharf with a military guard of honor to escort him to his temporary residence. The British chamber of commerce and other bodies would have vied with each other in honoring him in various ways. The American Ambassador to the court of the Mikado, the second ranking official of his government in the Orient, arrived in Shanghai unannounced, was received by the consul-general, driven to his hotel and for one solid week not one prominent American came near him. Why ?

Perhaps the editor of *The China Weekly Review* and *The China Press* can answer this question to the satisfaction of other Americans who resent the slight to Ambassador Woods when he passed through Shanghai. If not, we will answer it. Cyrus E. Woods was friendly to Japan. He turned the earthquake into the means of cementing the relations between Japan and America in everlasting friendship. He killed the intrigue to deprive Japan of an American loan.

He went further. He brought certain facts to the attention of the president and secretary of state and in a large measure contributed towards the drafting of the Executive Order signed by President Coolidge, which amongst other things put a stop to interferences with delicate international questions on the part of American commercial associations abroad a fact which has been carefully excluded from the columns of the *China Press* and *China Weekly Review*.

It is not difficult therefore to sense the reasons which have influenced the editor of these newspapers to belittle the work of Cyrus E. Woods. No American friend of Japan no matter how great his position, how honest and honorable his intentions, can hope for decent treatment from these newspapers.

* * *

Small Town Journalism

The Fourth Estate under date of March 15 prints the following interesting news item :

> " Dr. Henry W. Luce, vice president of Peking University, has consulted Director H. F. Harrington of the Medill School of Journalism of the Northwestern University for advice concerning the plans for a Chinese school of journalism. Dr. Luce said that he had been advised to come to the Medill school because it united the metropolitan view of the Pulitzer School at Columbia University and the small town newspaper viewpoint fostered by the University of Missouri. This combined type of school is what he believes will be most successful in China."

Dr. Luce concludes his interview with the startling information that " there are two kinds of news in China, one hard news, solid facts, and the other soft news, entertaining features." If the Medill system will turn out Chinese newspapermen with a metropolitan viewpoint and the ability to dig up hard news and solid facts, instead of aspirants for editorial positions endowed with the small town news paper outlook and a propensity for writing soft news, gush, and downright dribble, the Peking school will fill a long felt want. Turn them out, hard-boiled, Doctor.

* * *

Paper from Bamboo

THE 1923 report of the acting secretary for agriculture, S.S. and F.M.S., Mr. G. E. Shaw, contains a reference in its notes on the minor crops which have been the subject of local experiment that is of very considerable interest if read in conjunction with reports of similar researches, carried to a far more advanced stage, which are to be gathered from Madras papers to hand by this week's mail. We refer to Mr. Shaw's remarks under the heading of " Paper Pulp." " Considerable advance," he writes, " has been made by the agricultural chemist and his staff in their experiments with pulp from bamboos, Ialang grass, and foreign grasses grown for purposes of investigation at Serdang. A very excellent bleached pulp has been obtained from at least one of the bamboos."

That is excellent news so far as it goes, says the *Malay Mail,* and we shall hope to hear in time that the pulp is obtainable in sufficient quantities, and is producible under such conditions of manufacture, as will bring the financing of its production on a commercial scale within the sphere of practical politics. That good grades of paper can be made from certain varieties of bamboo and plants of kindred species is, of course, no new discovery, as was demonstrated years ago in India. But though we have heard of several tentative efforts being made of late years to launch a new industry on these lines in Madras, Bengal, and Burma, various technical and economic difficulties appear to have arisen in the course of most of these undertakings which have hindered the achievement of the real commercial success aimed at by their projectors. In this connection the investigations now in progress in the Madras presidency are of great interest. The particular variety of Indian bamboo known as " eta " reed has given really gratifying results, judging by the joint report of the chief forest engineer and Mr. W. Raitt, the Indian government's paper pulp expert, who declare that its product is likely to command better prices either than wood-pulp or ordinary bamboo pulp. Very large areas of it are available in the natural state, and as it reproduces itself on the ground every 3½ years under conditions that appear not to necessitate special cultivation, a perpetual supply is assured so long as it is worked in blocks under rotation. When its growth is contiguous, as appears to be the case in the Tinnevelly district, with natural water power of a type suitable for hydro-electric installations, paper production under the cheapest conditions conceivable will be a comparatively easy matter, or so at least the Madras government appear to think, and their optimism is supported by the views of experts. It may be added that another " side-line " contemplated is the manufacture of matches, in which " eta " reed has been utilized for years in Southern India. As the amount of reed used for matches is comparatively small, the match industry is expected to work very profitably in connection with a pulp-plant, the selected reeds being used for match-making and the waste from match plant, which will be considerable, being used for the manufacture of paper-pulp. It is, therefore, believed that the two industries, both using the same raw material, can be worked very economically in conjunction with each other.

More Oil

That Secret Russo-Japanese Treaty

THERE are many urgent political and economic reasons why Japan should compound her difficulties with Russia as soon as possible. Before his elevation to the premiership Viscount Kato urged the evacuation of Siberia and Saghalien as a preliminary step to a Russo-Japanese agreement, while Viscount Goto has practically staked his political career on bringing this about. No Japanese statesman, however, is willing to jeopardize his reputation at home and abroad by entering into a secret preliminary treaty whereby Japan is to equip Russia with the arms and munitions that would solidify her position in Eastern Asia and compel Japan in turn to increase her own military establishment. To suggest that Japan and Russia have entered into a secret treaty that would place Russia once more in a position to push forward her aggressive designs in territories which imperil Japan's vital lines of defense, in order that the Japanese navy might be conceded the privilege of sharing in the exploitation of Saghalien's doubtful oil reserves, is only another way of saying that Japan considers the menace from the sea to be more urgent than the " menace from the direction of Urga."

That influences are at work to create such an impression is plainly evident from the news dispatches sent to the *New York World* on June 18 by Alfred M. Murray, its Paris correspondent, and qualified by Moscow in an interview with *The New York Times* correspondent, as " utter rubbish." A month and a half later, the Paris correspondent of *The Morning Post London* picks up the same story and gives *Reuter's* the opportunity to spread it throughout the Far East, Reuter's however, circulated on the same day the statement of the Japanese government, that the report was " utterly false."

The original report sent *The World* by its Paris correspondent said that he had learned through " diplomatic sources " the provisions of a secret treaty of far-reaching character which was to be signed by Russia and Japan in which the latter was to furnish Russia with heavy artillery and war-ships, including vessels which should have been scrapped under the terms of the disarmament treaty. In return Russia was to cede to Japan all rights to the oil fields of Saghalien in order that the Japanese fleet might be independent of other oil supplies.

" Utter rubbish," was the curt reply of Theodor Rothstein, head of the Soviet press bureau at Moscow to the inquiry of the correspondent of *The New York Times* concerning the authenticity of the report. Rothstein, who in addition to being head of the press bureau is a member of the presiding committee of the Soviet foreign office, where he ranks fourth from Tchitcherin, said that the whole Paris report was preposterous, that negotiations with Japan appeared to be proceeding favorably.

Regarding Sakhalin, Russia continues to maintain its demand for Japanese evacuation, and the Japanese appear to be less uncompromising than previously.

From other Moscow sources the *New York Times* correspondent obtained confirmation of the favorable progress of the Russo-Japanese negotiations. The Japanese are said to be willing to return North Sahkalin in return for a most-favored-nation agreement regarding subsequent oil concessions. Russia is said to be willing to admit the principle of cash compensation for certain Japanese victims in the Nikolaievsk affair, which was made the pretext for Japan's seizure of North Sakhalin. Japan further is to receive important fishing privileges in Russian Pacific waters. There would be nothing intrinsically impossible in the Russian purchase of Japanese war material should Japan be willing to sell or rent small coast defense vessels, athough it was said to be more probable that Japan would sell her merchant vessels, which are greatly needed in Russian Asiatic ports, owing to the wholesale removal of old merchant fleet by the " whites."

Notwithstanding this denial, by the Soviet *The Morning Post* correspondent at Paris revived it on July 31. In denying it, Tokyo states that the report is being sytematically circulated for ulterior reasons and our own observations tell us that no newspaper in America commented on the original news dispatch and that after its denial in the *New York Times,* it died a natural death. The only newspapers which considered the report worthy of credence have been the anti-Japanese organs published in China which grabbed the "news" as a choice morsel for editorial comment and then ignoring completely the denial of the Japanese government, regaled their readers with further insinuations about Japan's backstairs diplomacy on the receipt of the Reuter's dispatch.

Japan is having a hard enough time as it is arriving at some equitable arrangement with Russia and there is every reason to believe from official statements that one of her basic conditions is the cession of important oil rights in northern Saghalien. The American public has been told on more than one occasion that it would have to fight Japan because of her forcible usurpation of rights ceded by the Soviet to an American oil company. The present trend of Russo-Japanese negotiations towards firmly establishing Japan's rights to participate in the exploitation of these deposits, would therefore materially damage the prospects of the American company to a monopoly in the disputed territory. It would be most interesting and enlightening to know the exact origin of the story communicated to the Paris correspondent of *The New York Times* and a month and a half later to the Paris correspondent of *The Morning Post.*

It was only a few months ago that two American surveyors representing the Sinclair oil interests attempted to enter the northern section of Saghalien to prospect the concession granted by the Soviet and were turned back by the Japanese military authorities. Their treatment was most courteous, but they were given firmly to understand that while the Japanese army was in supreme command of the administration of Saghalien, Americans would be forbidden to invade the island to prospect for oil. The incident emphasized that although Japan recognized Russia's sovereignty in northern Saghalien, she insists upon retaining possession of the territory as a guarantee for satisfaction for the massacre of 700 Japanese by the Soviet at Nikolaievsk in 1920. This attitude is quite comparable to French occupation of the Ruhr and has other historical precedents to justify it.

Japan's oil reserves, never very large, have been dwindling rapidly. The Akita and Niigata fields are becoming exhausted, the output decreasing year by year while the demand is steadily increasing. At present, half of Japan's oil supplies are imported and because of the high market price many large Japanese manufacturing plants which were preparing to use oil as fuel discovered that it was dearer than coal and abandoned their projects. The Japanese navy oil reserves destroyed last September in the earthquake and fire made it imperative for the nation to become independent of foreign importations and develop its supplies in territories near at home.

Aside from the diminishing domestic fields and the shale deposits of South Manchuria the only place which offers Japan a possibility of freeing herself from foreign oil importations lies in northern Saghalien. It is not strange, therefore, that every effort is being made to prospect and develop these deposits while the territory remains under Japanese military occupation. An enterprise known as the Hokushin Kabushiki Kaisha (North Star Company) was created by a combination of the Mitsui, Mitsubishi, Okura and Suzuki interests with a capital of Y.3,000,000 and a subsidy from the navy department of Y.2,000,000, to prospect and work the Saghalien deposits. Three wells are reported to have been sunk and are now producing oil which is being shipped to Japan for the navy. It is highly improbable that Japan will surrender this advantage and it is still more improbable that America will interfere in behalf of a company which was granted an oil concession in Saghalien for the sole purpose of forcing our government to recognize the Soviet and to create difficulties with Japan. The oil scandals at Washington have effectively killed any possibility that Americans will spring to arms in behalf of Mr. Sinclair and his associates in the oil business.

It would be the supreme gesture of the bully, if after stripping Japan of her defensive advantages in China, Manchuria, and Siberia, inducing her to subordinate her naval program to a 5-5-3 ratio, and slapping her face over the immigration law, if we should now intervene to deprive her of a basic necessity upon which rests her ability to maintain a modern war-fleet. If America had embarked upon a definite program to force Japan to fight, this constant weakening of her power of attack might be defendable, but even at that, we reject the idea that any self-respecting American soldier or sailor would take pride in fighting an enemy on such unequal terms. To deprive Japan of her only chance to develop an independent oil supply must in the long run impair her reduced naval efficiency and hand over to America control of the Pacific.

From one angle it might be a good thing for Japan to be deprived of an independent oil reserve. With the Japanese out of the naval race, the American tax-payer would be relieved of huge annual appropriations for the upkeep of a fleet in the Pacific. Our Japanophobe jingoes and strategists would then have to hunt around to find some one else to pick on in order to squeeze the money for armaments out of a reluctant congress. It would then be squarely up to the United States to reduce its fleet in the Pacific and permit Japan to work out her destiny in her own way without facing the perpetual outside menace of interference. With the Japanese fleet emasculated by an inadequate supply of oil fuel there would be no longer any valid reason for maintaining the 5-5-3 ratio of armaments and an end would come to this interminable yapping about war with Japan and calling upon congress for the annual appropriations of millions to maintain the nation in a state of preparedness against a crippled sea power.

It is too much to hope that the elimination of Japan as a first class naval power would satisfy our jingoes. It might deprive them of the argument that the nation must prepare to defend its territory against an Asiatic invasion but on the other hand it would provide a new opportunity for those who consider it our bounden duty to pose as the protector of China to revive the cry for a larger navy in order to defend the open door and any attempt to discriminate against our trade in this country. Despite the fact that our investors have never had the curiosity to see what lies beyond the door that has been held open for them these past two decades, while all this time hundreds of millions of Japanese yen have been pouring into the country to develop its resources and industries, our jingoes will see in this legitimate commercial movement a menace to China's sovereignty and a closing of the door to equal opportunity. The cry for a greater navy will again be heard.

* * *

Trade Follows the Loan

EVER since Wall Street became the money centre of the world, there has existed a difference of opinion as whether international loans should be made with the proviso that the borrowing countries spend the credit in the United States for the purchase of materials, or whether the loan should be a purely financial operation without such conditions. Our bankers, as represented in the consortium, inclined to the view that loans should be made without a proviso for the purchase of American materials, permitting China to purchase her requirements in the open market, At that time, the larger American manufacturers of railway equipment believed they could meet any possible competition for years to come and sided with the bankers.

Although no advances have been made to China for construction purposes, the discussion has again been revived owing to the many international loans floated in America without any proviso for safeguarding the interests of our manufacturers. Commenting on this situation *The Brooklyn Eagle*, says :

> "Borrowers from all over the world are applying for loans. In a few months past Japan, Sweden, Switzerland, Holland and the city of Rotterdam have obtained loans. Others are pending. In a sense New York has been the money capital of the world since the beginning of the world war. And still gold in an unceasing flood is pouring into the country. The connection between gold and the future of our trade should be obvious. New York now has first place. If America desires to keep it, she must take a leaf from Britain's book. Britain gave freely of her gold and brains to develop the world. Many of our great railroads, our flour industry and other enterprises owe their existence to British capital. South America also was developed largely by Britain. So also must the United States lend to foreign nations, helping to promote the standard of living of all the world. The alternative is loss of trade and probably domestic stagnation."

This side of the argument follows the system under which French financiers for many years dominated the world's money market at a sacrifice of national industry. To take a concrete example. France financed at least three-quarters of all the railways in China, yet aside from furnishing the equipment for the Yunnan and Cheng-tai lines, her manufacturers were left out in the cold in the supply of materials for the other lines. French national economy got no returns from its investment other than the interest on the bonds. It was not until January, 1914, that the French manufacturers woke up to this situation and demanded that all future French loans for construction work abroad should provide for the purchase of French materials.

In this they were guided by the British example, who at that time were conducting a vigorous propaganda to have all British loans employed for the advancement of their own manufacturers, overlooking that in many instances, a large proportion of these loans were taken up by French investors. We expressed the opinion at the time the American bankers announced their determination to make loans to China without any qualifying conditions, that American money loaned to China for construction work, should follow the precedent created by Great Britain, otherwise, our manufacturers would get precious little business in an open competition with Europe.

The Saturday Evening Post supports this attitude in its issue of July 5, in an editorial entitled "The Use of International Loans." The article follows:

> "Two or three years ago, when we were actively engaged in making foreign loans, the suggestion was advanced that such loans should be made with the proviso that the borrowing countries spend the credit in the United States. There was a considerable body of public opinion holding the view that we should make some such stipulation in support of our export industries, since it was believed that other countries, notably Great Britain and Germany, had done the same thing. This led a distinguished American banker publicly to controvert 'the fallacy that it is good business to compel our foreign borrowers to earmark and themselves spend their credit in this country.' This was in conformity with the traditional concept of a foreign credit—that a credit to one foreign country was in effect a credit to all foreign countries, and that at some future time some one or other foreign country would use it to buy goods from the lender. Accepting this proposition, that a loan would always, sooner or later, in one direction or another, find expression in a corresponding increase of exports, one would still have to assume a continuity of international trade, in terms of comparable prices and exchange rates, if one were to regard the deferred use of the credit in the market of the lender as equivalent to the immediate use. The British are an astute people. Let us observe their present stand on this question.
>
> "Some time ago Great Britain made a loan to India. At the time an amendment was moved to the East India Loan Bill to the effect that 75 per cent. of the sum should be spent in the markets of Great Britain. Parliament rejected the amendment, in accordance with the traditional theory. London is now profoundly shocked to learn that the Indian State railway administration is spending a large part of the loan in Germany, at a time when British industries are partly idle and labor is unemployed.
>
> "The government of Argentina has been negotiating a loan with a syndicate of London bankers. It was recently announced in Argentina that the offer of a loan of thirty million pounds sterling for construction of public works had been made under the stipulation that the materials should be purchased in Great Britain.
>
> "Thus we observe the experienced international bankers of London subscribing to the 'fallacy' that it is good business to compel foreign borrowers to spend their credit in the country of the lender. Apparently it is felt that circumstances alter cases. The industries of Great Britain want orders now, not next year or in several years. They do not want to wait while Argentina spends the sterling in the United States, then we spend the sterling in Asia and the Asians finally spend the sterling in Great Britain. They want immediate, not deferred, relief from inoccupation and unemployment. Secondly, it seems to be felt that British loans to foreign countries tend to depreciate sterling exchange unless the credits are spent in Great Britain. Finally, it is believed the loans could be used to build up in other countries new industrial plants that would make injurious competition for Britain.
>
> "If the British are adopting the plan of joining trade stipulations with loans, perhaps we should follow suit. It may, theoretically, be possible to prove that this might be advantageous for Great Britain but not advantageous for us. But we shall doubtless make the assumption that what is good for Great Britain is good for us. If the loan is to stipulate the trade in London, the loan ought to stipulate the trade in New York. Perhaps London is making a mistake; if so, we can afford to have New York make the same mistake, that London makes."

Exactly. *The Saturday Evening Post* is right. Great Britain knows her business. Her bankers do not make many mistakes in lending money for construction work in non-manufacturing countries. They cannot afford it. It is true that British money largely helped to build up American transportation and industries, but it is also true that by our protective tariff system we made it impossible for British manufacturers to compete with our infant industries. The British accepted our loans as an investment and sought their markets in backward countries compelled to purchase their requirements from abroad. There are instances, even here, where they got stung, like in the original loan to the South Manchuria Railway Company, where after lending the Japanese $100,000,000, the latter proceeded to spend it in America, creating for our manufacturers a market which to date has brought them orders to the extent of $100,000,000. It nearly broke up the alliance. Now it is entirely probable that a similar American loan for the construction of Chinese railways without any proviso for purchasing American materials, will do the same thing for Great Britain and other European countries. In fact, the present tendency will throw all these orders to Germany or Belgium. Altruism and philanthrophy will probably prevail when the time arrives to do something tangible in China and Americans will have the satisfaction of advancing the money in order to create a market for European manufacturers that will develop in time through repeat orders into a sphere of commercial influence whose door while technically open will be hermetically closed to America.

* * *

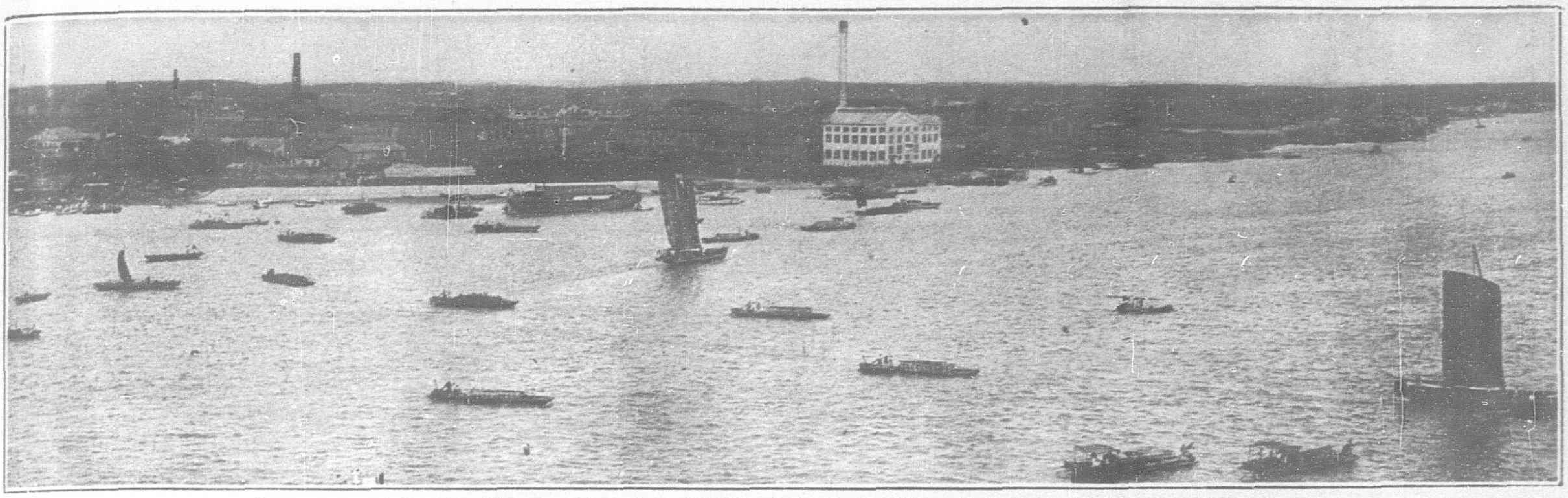
The Underpaid Engineer

In commenting last month on the disposition of the Boxer indemnity funds for educational purposes, we drew attention to the large number of technical graduates turned out annually from the three Chinese government colleges who find it almost an impossibility to obtain work. To this number must be added the annual output of engineers from the indemnity students educated in America. All the railways and many of the industrial and mining enterprises in China have been built with European or Japanese capital and those in charge are not keen on finding employment for engineers whose influence might divert orders for materials to American manufacturers. Japanese controlled enterprises in China employ Japanese technical experts or Chinese educated in Japanese schools, who although loyal to their own materials whereever possible to use them, favor American material for their railways and British material in their textile plants. It is difficult for an American trained Chinese to obtain employment on railways or in industries controlled by European capital.

We have cited this situation on more than one occasion as a reason why American capital should be used in creating enterprises in China that will supplement our educational activities and provide employment for our protegés. The engineer's lot is had enough even at home, where his remuneration is now on a par with the school-teacher or country parson. To keep turning out hundreds of young Chinese engineers and casting them adrift in China without prospect of work, is to further cheapen the profession and make it more and more difficult for those on the ground to prosper. In commenting on the remarkable change in the starvation salary list which formerly was headed by the professor, *The Saturday Evening Post* calls attention to the fact that this distinction is now held by the engineer. It says:

> "Engineers, technologists and men of science, taken as a single group, must now be at the top or very near the top of the list of the conspicuously underpaid. We exempt from this classification those engaged in selling and those who occupy high executive positions. We include in it those whose work is strictly professional.
>
> "Bureau scientists in Washington, conspicuous examples of the faithful public servant, work for salaries that a self-respecting plasterer would call cigarette money. Research men in the laboratories of great corporations fare better, but by no means well. Engineering experts in a dozen fields, well equipped specialists, are often so ill rewarded that they find it hard to live in modest comfort.
>
> "These conditions are beginning to produce the inevitable result. Educators who are trying to assist young men in their selection of a career are telling the truth about the engineering professions and are comparing them unfavorably with other fields of activity. Engineers themselves are equally frank when advising their young friends. Clear-thinking, well-trained young men are too precious an asset to put into blind-alley jobs.
>
> "Scouts from the great industrial corporations each spring look over the graduating classes of our technical schools with a view to engaging promising students. Of late they have been complaining of the insufficiency of the material at their disposal. In some instances they have been frankly told that they want too much for what they are willing to pay and that they cannot hope to find their needs fully supplied until they are prepared to pay a fair price for the costly and hard-won mental equipment whose benefits they desire.
>
> "From colonial times our people have had a genius for mechanics, invention and applied science. It would be a national calamity if we should be so shortsighted as to starve out this priceless talent. If there is any one thing about our social evolution that is certain, it is our growing dependence upon science to solve the problems of peace and war and everyday life. To weaken by neglect or indifference those powers upon which our future existence may depend would be sheer folly."

If such an argument is good for America, where opportunities abound, how much more forcible it is when applied to China. Our present system of educating young Chinese engineers and trusting to the good nature of commercial rivals to give them jobs that will undermine their trade, is to say the least, somewhat foolish. The logical outcome of this system will be to lower salaries to a level that will turn the young aspirant for engineering honors to other fields of usefulness, or to accept jobs where his American training will go for naught. There is only one remedy for all this, and that is the investment of American capital in Chinese industries where our philanthropies will be given an opportunity to advance our trade interests.

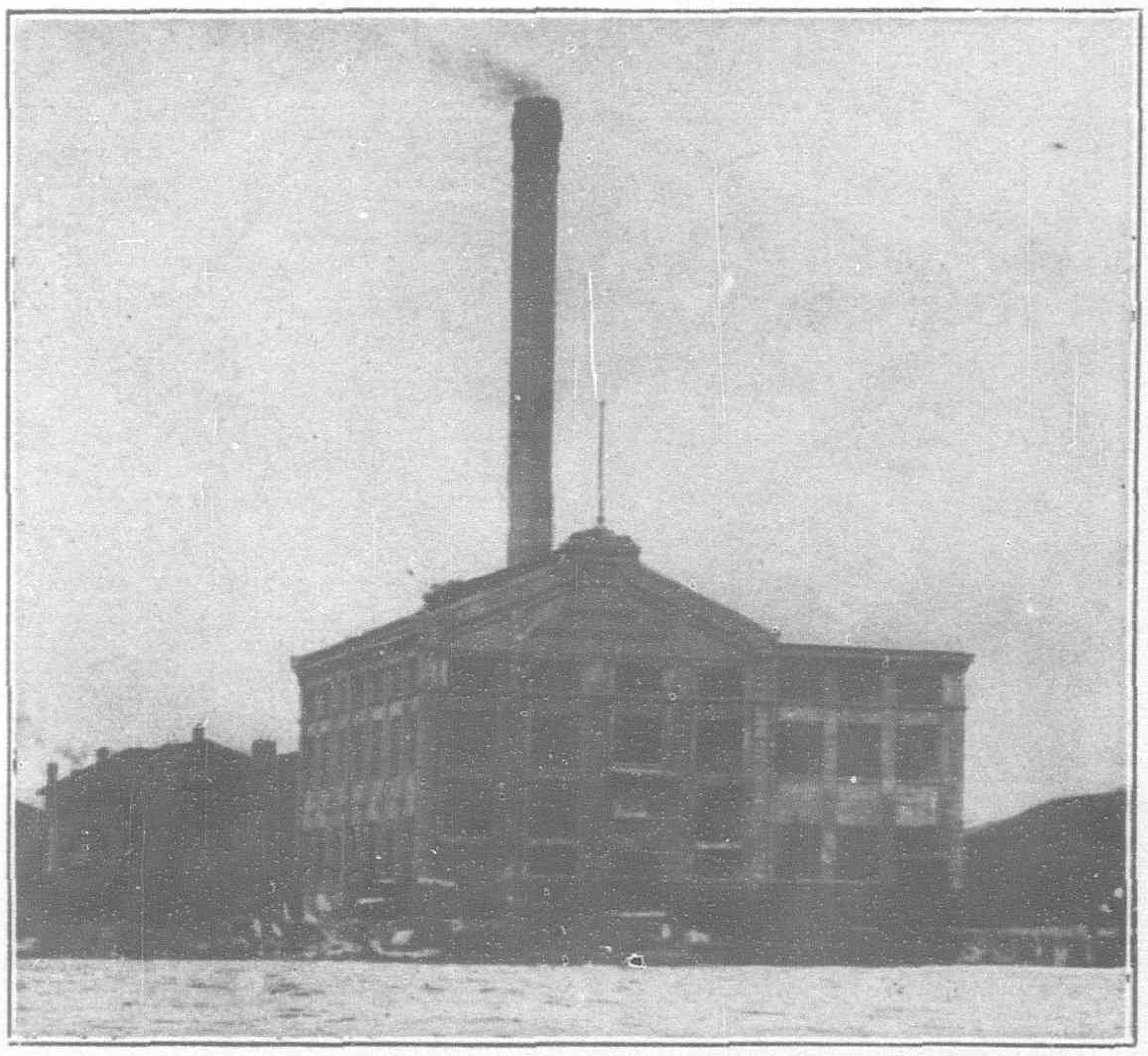


Panorama of Pootung Showing Location of Mills of the Japan-China Spinning and Weaving Company

The Japan-China Cotton Mills at Shanghai

Four British Equipped Mills Now Operated by Electricity

OVER on the Pootung side of the Whangpoo, towers a stack surmounting a building whose impressiveness makes it one of the industrial landmarks of Shanghai. By night a blaze of light, it is by no means a pillar of smoke clouds by day, although it is generating the power for more than 52,000 cotton spindles and 500 looms operated by the Japan-China Cotton Spinning and Weaving Company. Day by day it produces the 2,000 kilowatts that keep the spindles turning and the looms whirring to supply the almost insatiable demand of the Chinese for cotton goods and yarn. This powerhouse with its air of solidity emphasizes in a way the manner in which this and other Japanese owned cotton mills in China are building for a future which even the most sanguine believer in China's possibilities dares not attempt to predict.



Powerhouse and Mills of the Japan-China Spinning and Weaving Co. at Pootung

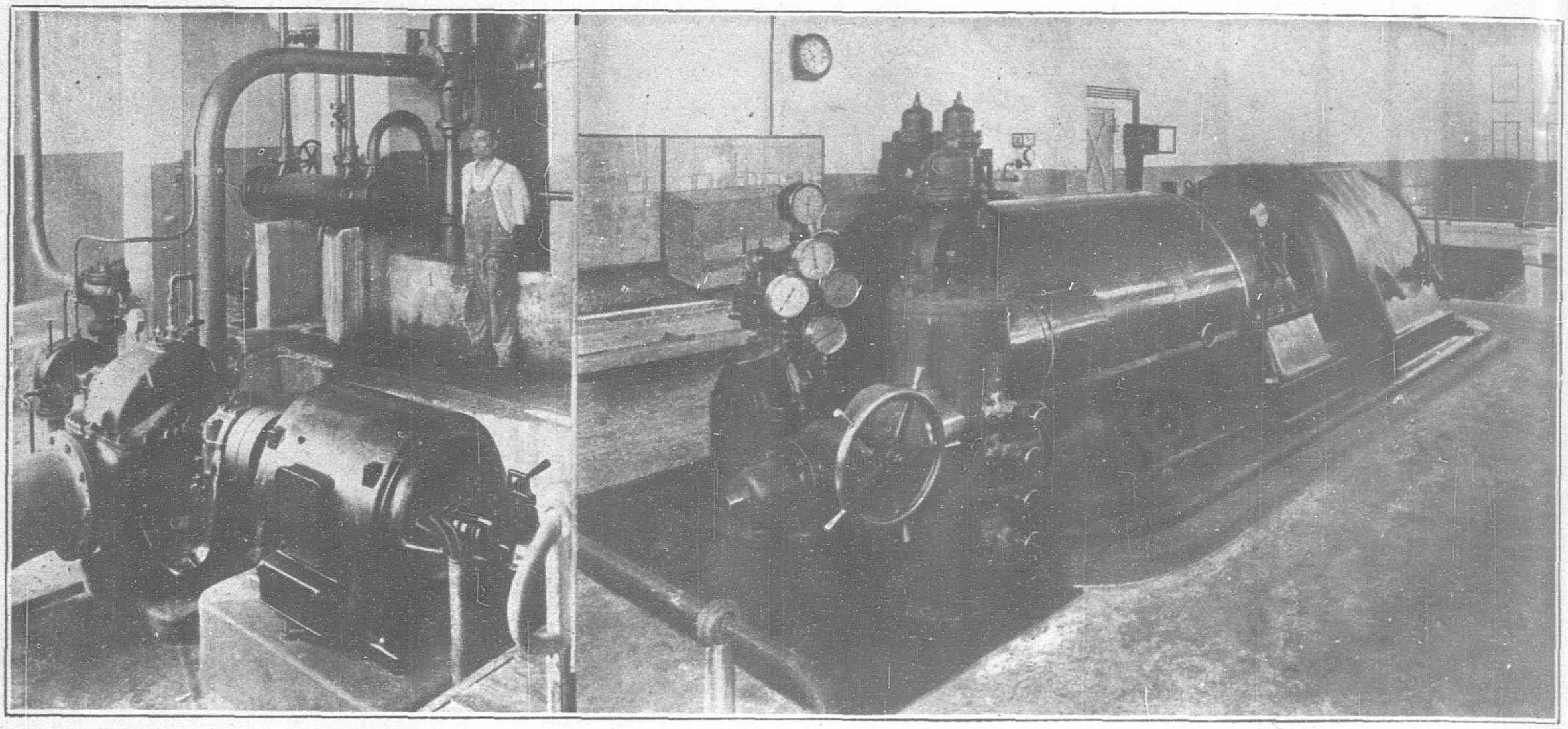
Down to date, the Japan-China Spinning and Weaving Company has invested almost nine million yen in its four mills in Shanghai, two on the Pootung side and two on Robison Road. The powerhouse serves both the Pootung mills which were the first purchases of the company in China. They were taken over in 1918 from a British company, the International Cotton Spinning and Weaving Company, and comprised the two mills with about 53 mow of land. The mill buildings themselves cover an area of some 38,000 square feet while godowns and other buildings account for some 15,000 square feet more.

The ample area of ground back of the powerhouse is remarkable in that so much of it is given over to the welfare of the workers. Not only do the actual dwellings for the Chinese employes cover 45 mow of ground, but other cultural advantages are afforded, among which is a commodious church for the accommodation of the large number of workers who have embraced the Roman Catholic faith. They are thus enabled to discharge their religious duties without leaving the mill grounds. Education as well as religion is amply provided for with primary schools where men and women separately, are taught the rudiments of their written language as prescribed by the courses of the Chinese primary schools. The day nursery idea to care for infant children of the women workers also has been put into effect and a commodious house has been set apart for the use of babies and nurses who tend them while their mothers are at work in the mills.

Nor has cultural work been lost sight of the other mills of the company. In the Robison Road mills, Nos. 3 and 4 an area of 69.5 mow has been set aside for residences and workers' quarters, while in Formosa also, the larger portion of the company's holdings is given over to the workers who are furnished with modern and sanitary dwellings. All of the mill compounds of the company have large open spaces to allow for future extensions, the Whangpoo River front of the Pootung mill having more than 28 mow of ground which can be built upon when occasion arises, the total amount of land owned or under lease by the company being some 100,000 tsubo.

The company contributes in no small way to the prosperity of the Chinese working class as it employs in its mills more than 2,000 men and 5,500 women. The average wage for men is fifty cents a day and for women 43 cents, considerably higher remuneration than prevails in some other local cotton spinning and weaving mills. In addition to the factory workers, the company has 156 clerks and engineers and 38 office assistants on its payroll.

The Japan-China Spinning and Weaving Company was organized in Japan in July, 1918. Its original capital was fixed at Y.10,000,000 of which Y.4,000,000 was subscribed. This was the initial venture which resulted in the purchase of the International mills in Pootung. Within 18 months, another call was made for Y.2,000,000 more, making the paid up capital Y.6,000,000. Following this, in June, 1921, the company saw possibilities in the use of ramie fibre for which there was a considerable demand in Japan, and bought the Formosa ramie spinning and weaving mills at Taihoku. The capital was then increased to Y.11,000,000 and a



Electrical Equipment of the Pootung Mill of the Japan-China Spinning & Weaving Co., Ltd.

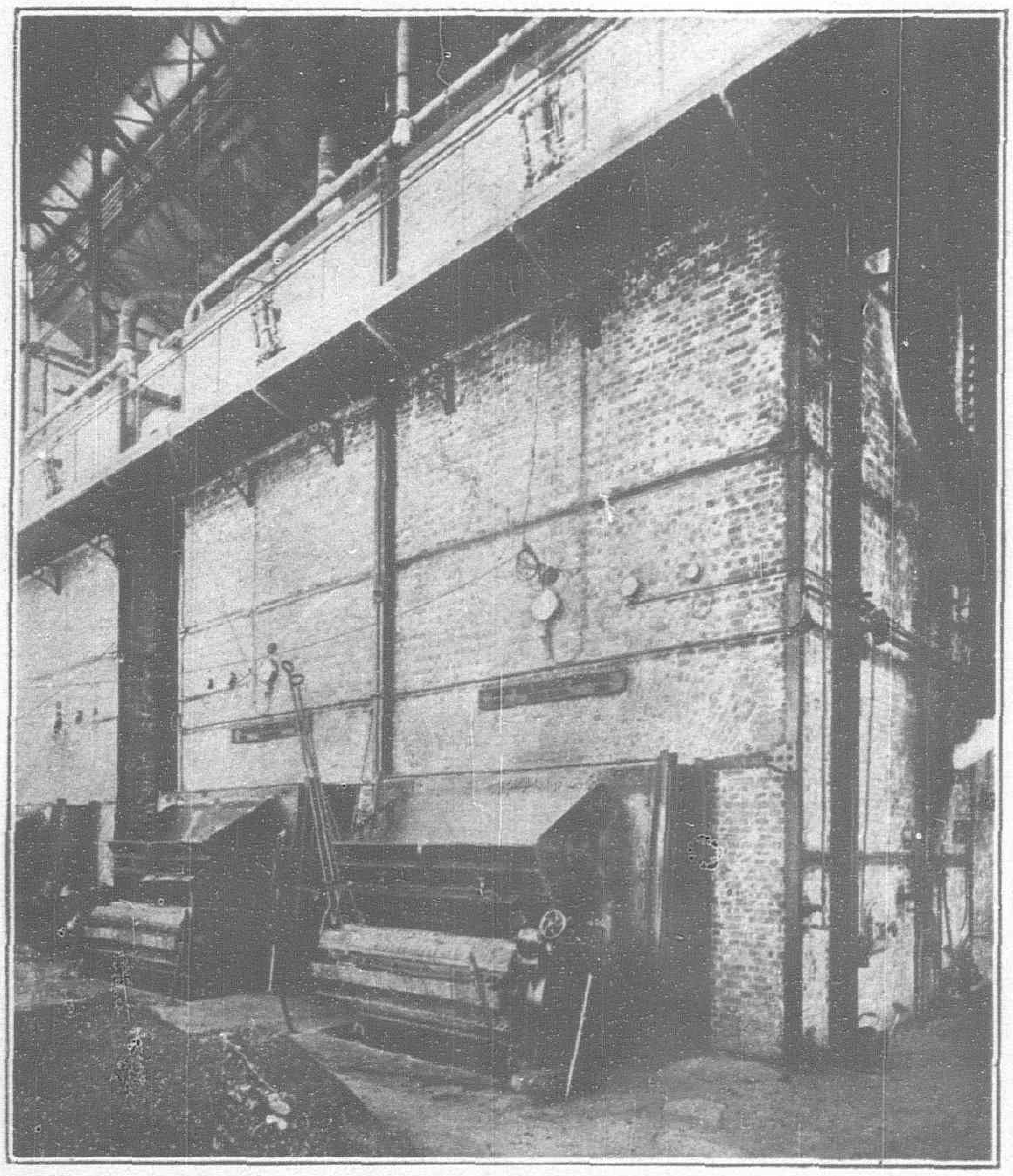
Brown, Boveri Condensing Plant, Pumps and Ejector

2,000 k.w. Brown, Boveri, Turbo-Generator

total of Y.6,600,000 was called up for investment. The capital was later increased by calling up an additional Y.2,200,000 and the company now has general reserves of Y.1,525,000.

In July, 1921, the company finished the construction of its No. 3 factory in Robison Road in which 30,000 spindles are installed. Two years later, in June last year, the No. 4 mill in Robison Road also was completed. This mill has 25,000 spindles making the total spindles operated by the company in China some 107,000 aside from the 500 looms at the Pootung weaving plant and the 5,100 ramie spindles and 1,048 doubling spindles operated in Formosa. The mills' spinning and weaving equipments are wholly of British manufacture as follows :—

Pootung No. 1 Mill, 40,400 spindles (Asa Lees)
,, No. 2 Mill, 11,856 (Platt Brothers)
,, No. 2 Mill, 500 looms (Gregson Monk.)
Robison Road Mill
No. 3, 29,952 spindles (Platt Brothers)
No. 4, 25,000 spindles (Dobson Barlow)
Taihoku Mill (Ramie), 5,100 spindles (Greenwood and Batley)
,, Mill (Ramie), 1,048 doubling (Greenwood and Batley)



Sulzer Boilers in Pootung Mill, equipped with Underfeed Stokers

The Power House

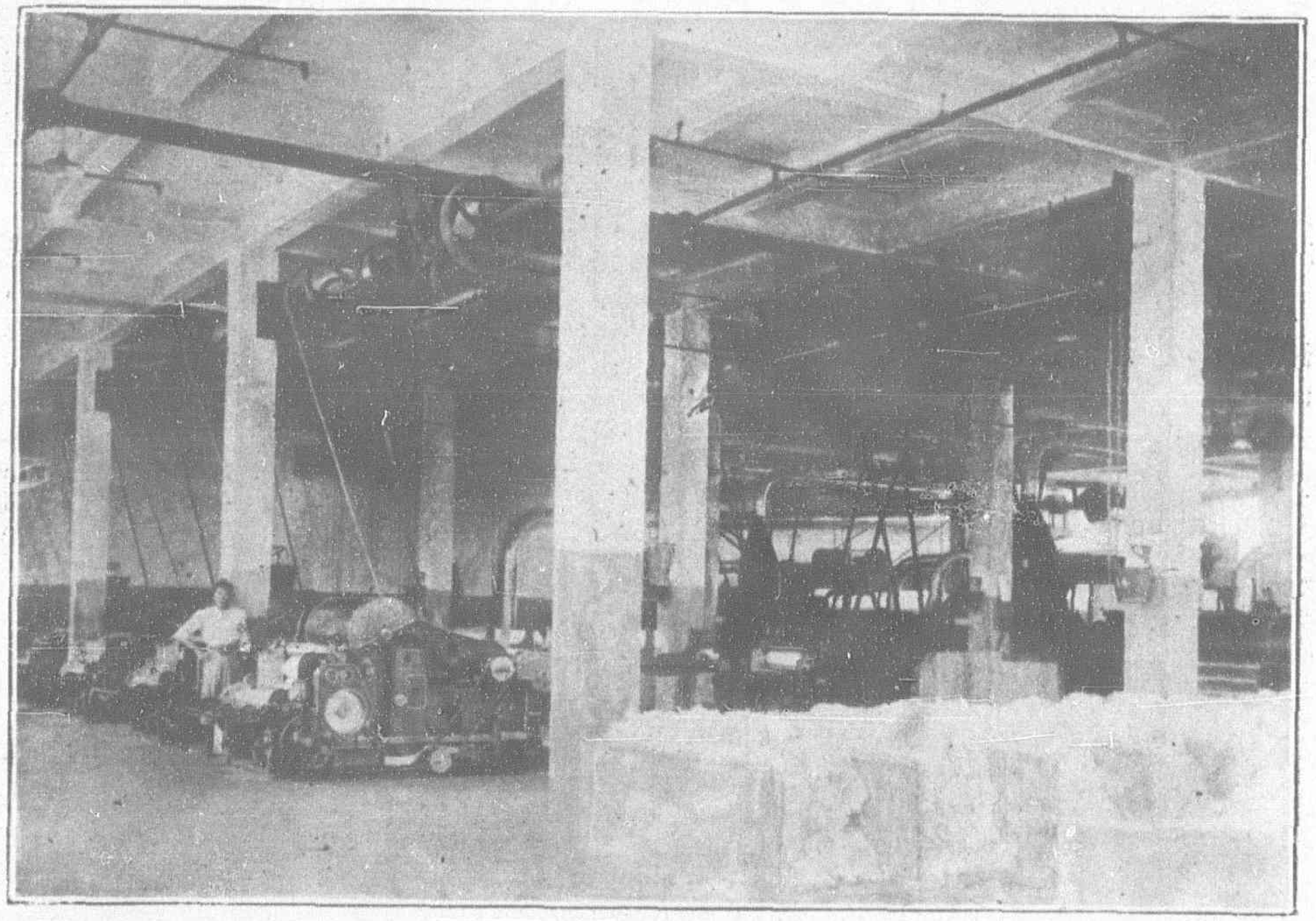
When it was decided to electrify the Pootung mill on account of the case of operation experienced in the other mills of the company through electric drive, the contract for the prime mover, a turbo generator of 2,000 k.w. was given to the Sintoon Overseas Trading Company, Shanghai agents for the Brown, Boveri Company, and the boiler contract to Messrs. Sulzer Brothers of Winterthur, Switzerland. The three boilers are of the Sulzer-Galbe type having 250 square metres of heating surface and operate at a pressure of 200 pounds to the square inch. One of these is kept for spare. The boilers are fed by automatic travelling grate steers made by the Underfeed Stoker Company, Ltd. of London.

The 2,000 k.w. turbo generator is of the standard Brown, Boveri Impulse Reaction type which was developed out of the original Parsons design by replacing the small high pressure reaction blades by impulse blading retaining the reaction system in that part of the machine where it can be used with highest efficiency, i.e., at the low pressure end. This turbine is equipped with the well-known oil pressure governing gear by means of which the steam admission of the nozzles is regulated in such a way that the throttling losses are extremely small. The turbine is built for 200-lb. per sq. in. pressure at the admission valve and 590°F. steam temperature and the specified overload is 25 per cent. The generator is coupled to the turbine by means of a semi-flexible coupling. Its normal continuous output is 2,500 k.v.a. at 2,300 volts.

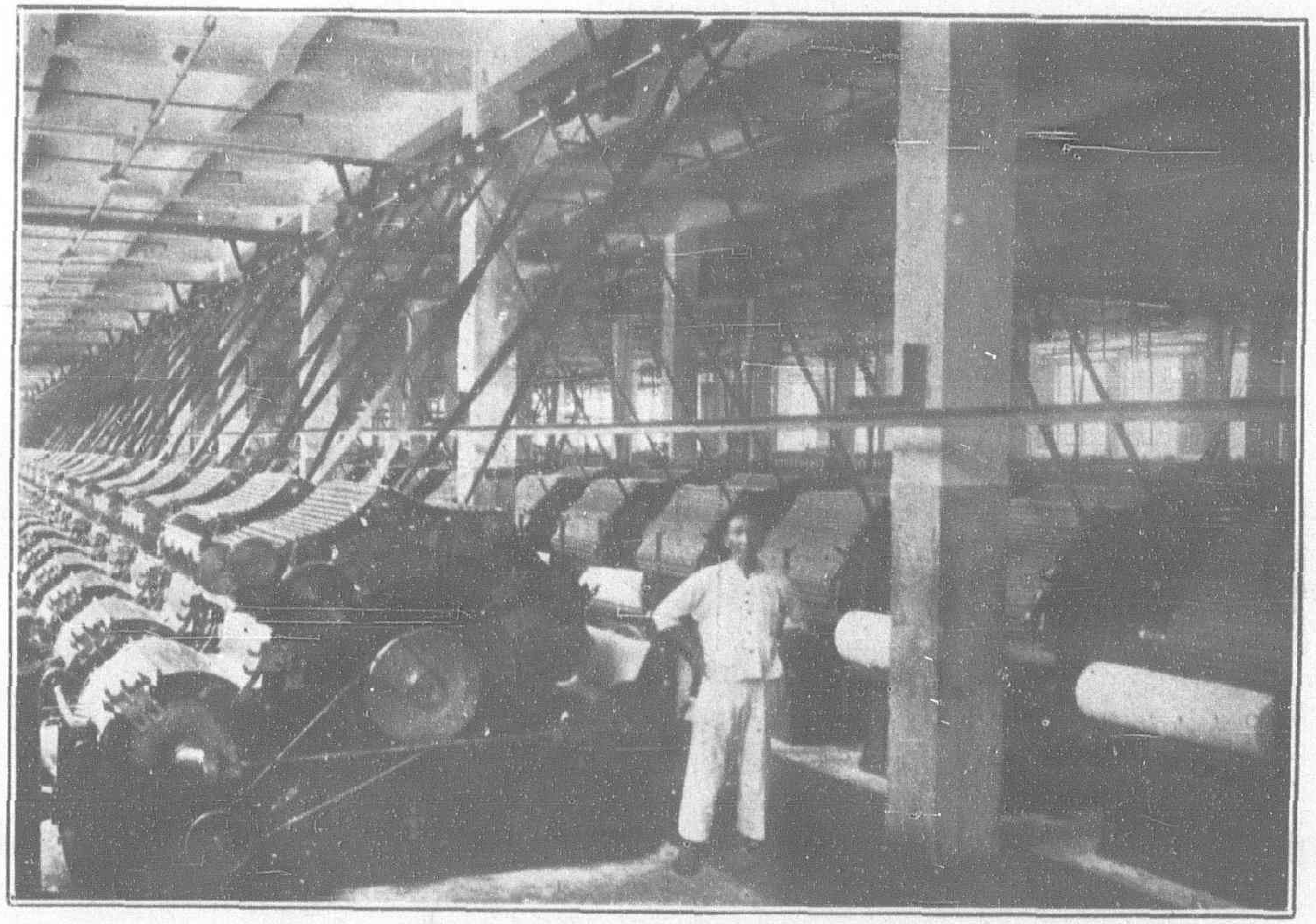
The direct coupled exciter is fitted with special pole pieces making it possible to regulate the tension by means of a shunt rheostat only, the main exciter terminals being directly connected to the rotor of the alternator. The cooling air of the generator is filtered by means of a sectional oil filter which is so built that it can be cleaned during service. The resistance of this filter remains practically constant. The turbine exhausts into a Brown-Boveri patent two-part surface condenser which is so built that it can be opened for cleaning pur-

THE POOTUNG MILL OF THE JAPAN-CHINA SPINNING & WEAVING CO., LTD.

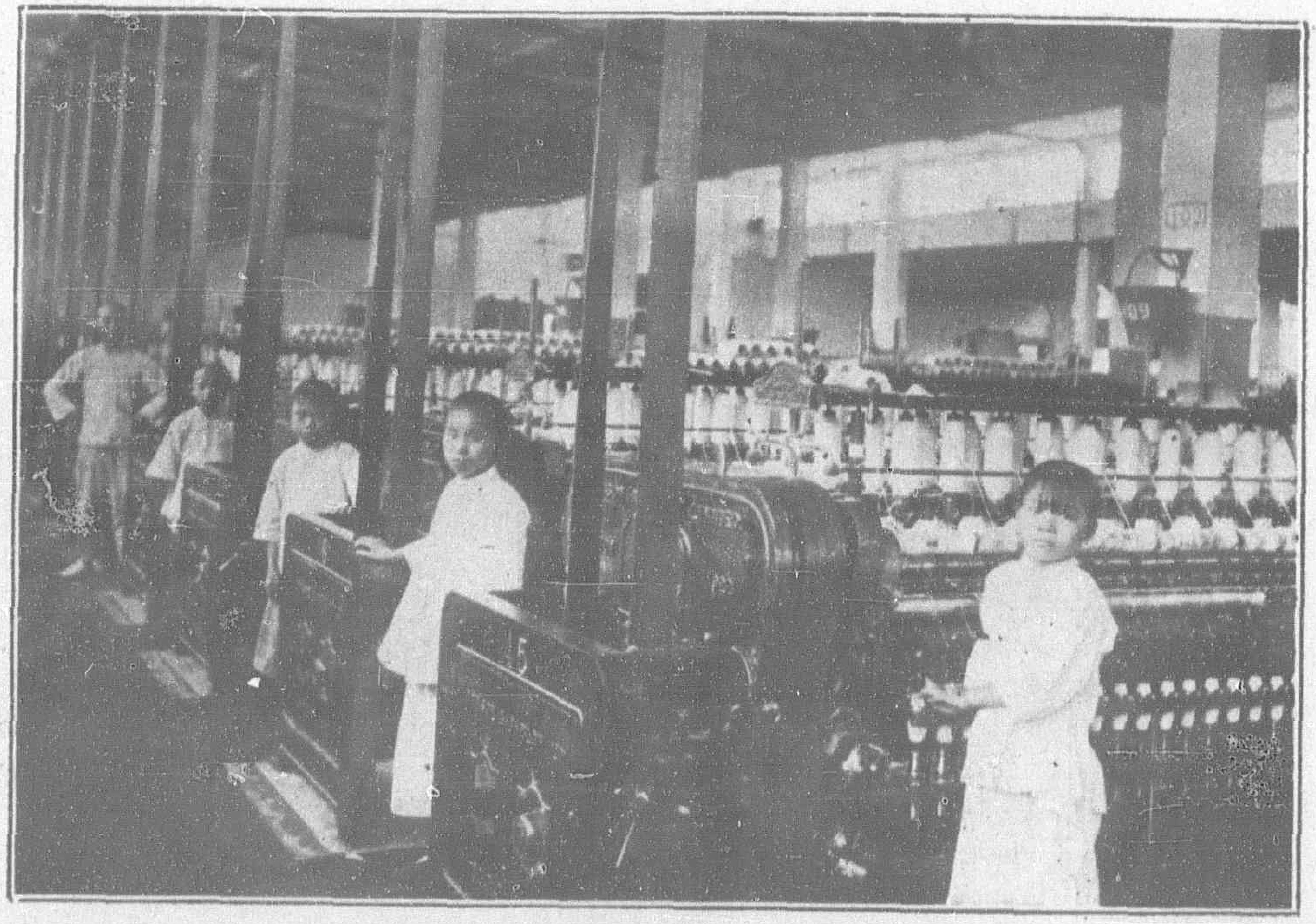
Equipped with Dobson & Barlow, Ltd. Machinery



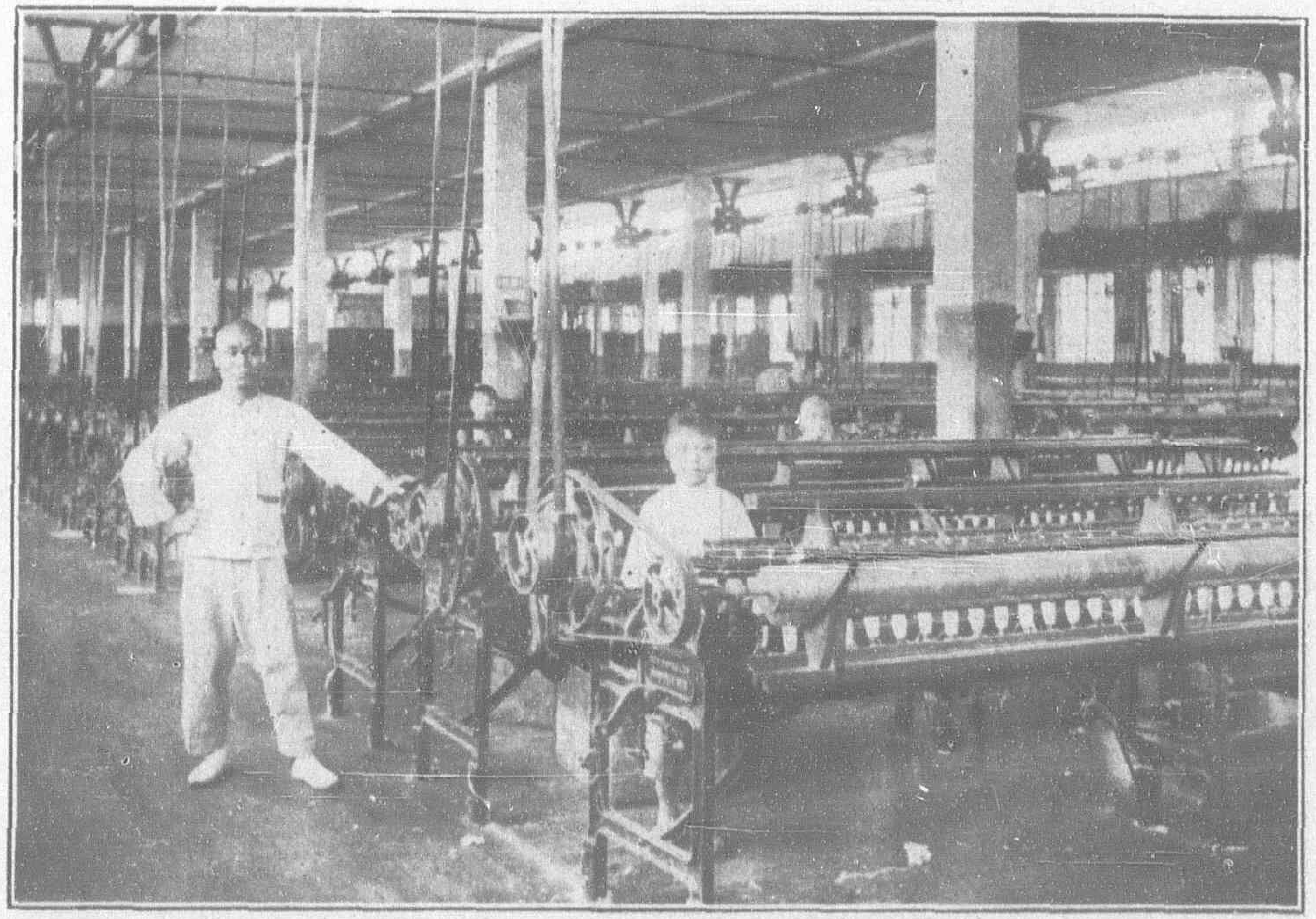
Blowing Room



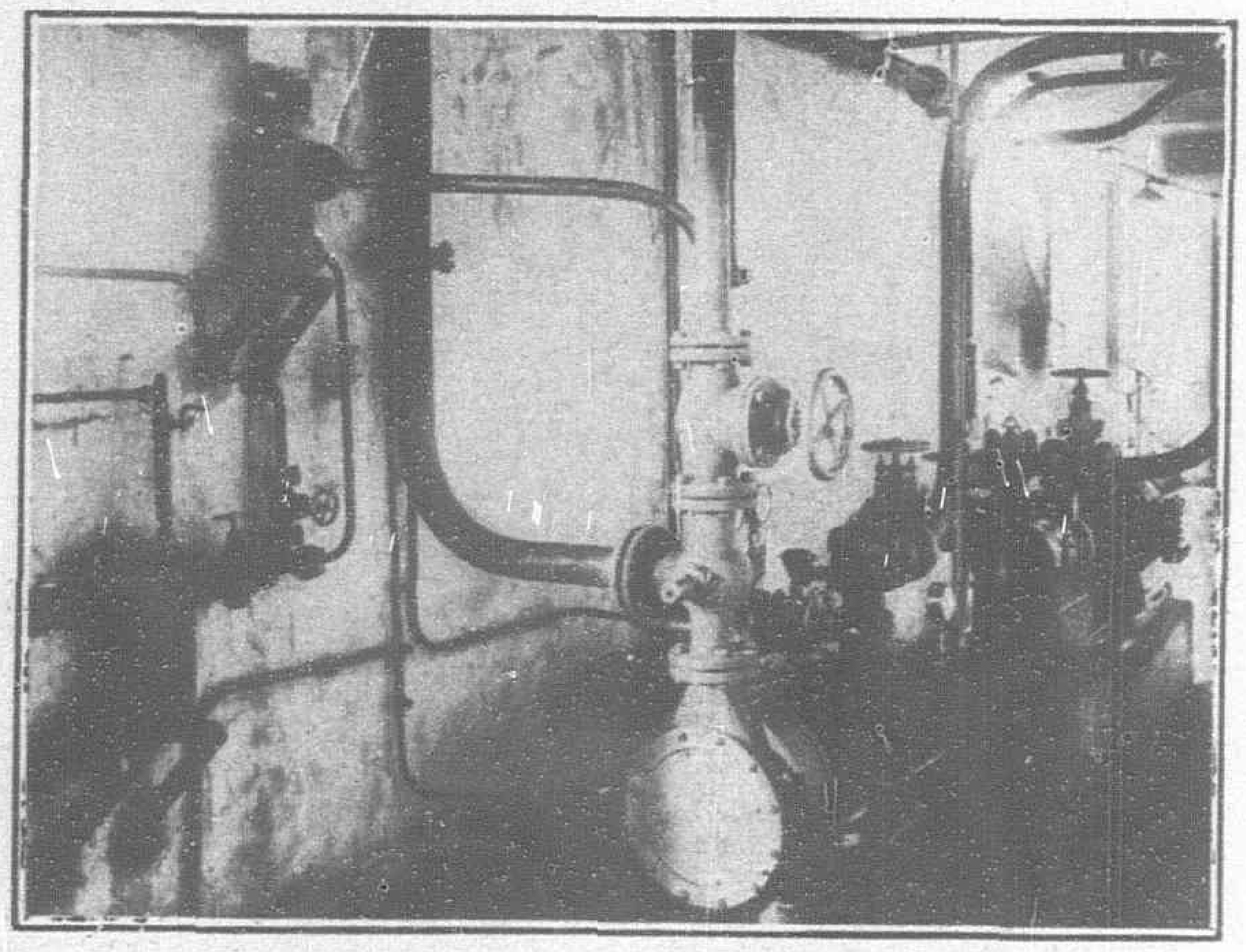
Carding Room

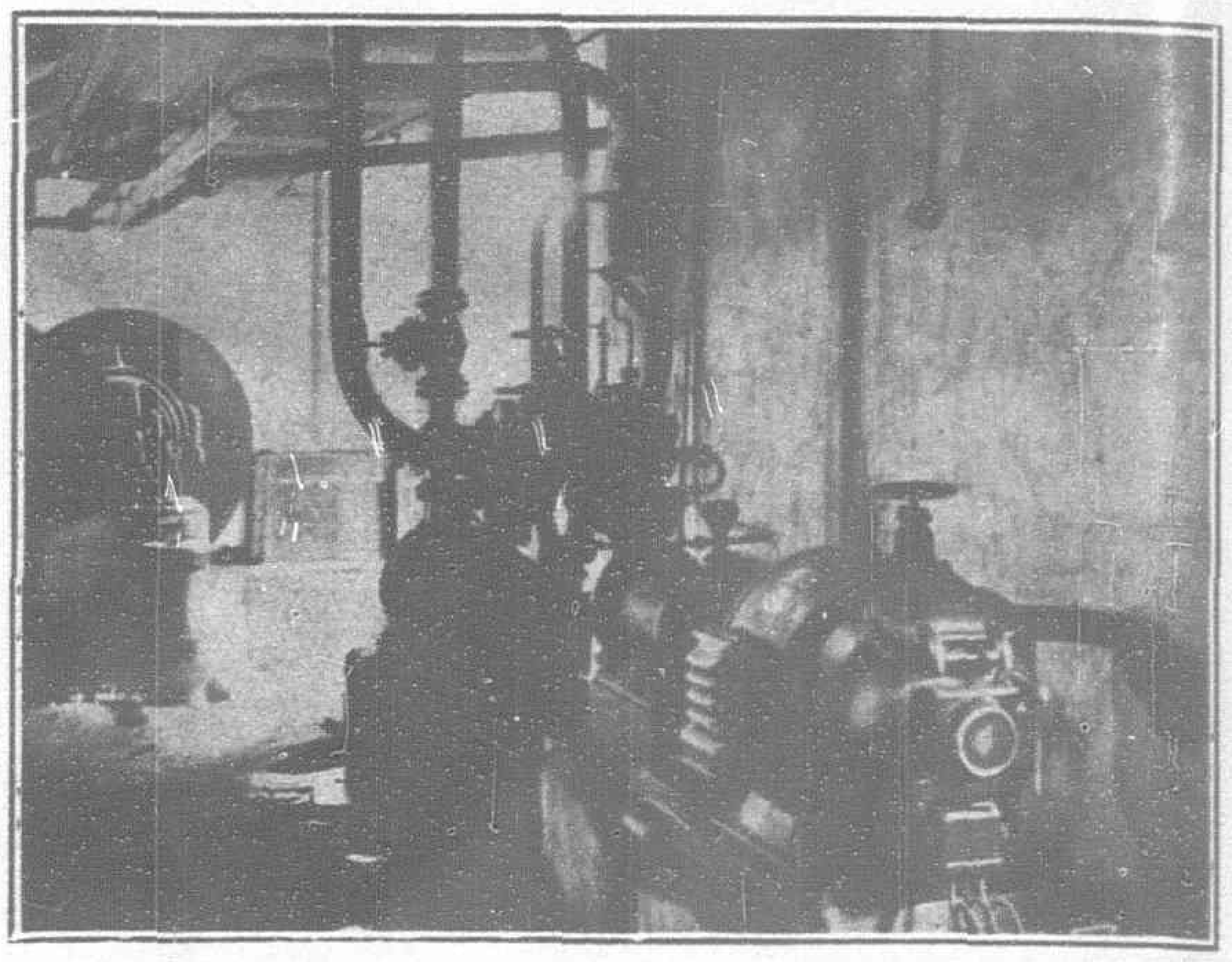


Spinning Room



Reeling Room: Reels Manufactured in Shanghai


Sulzer Steam Turbine Driven Boiler Feed Pump and Electrically Driven Feed Pump


Sulzer Boiler Feed Pump. Sulzer Fan for Stokers in Background

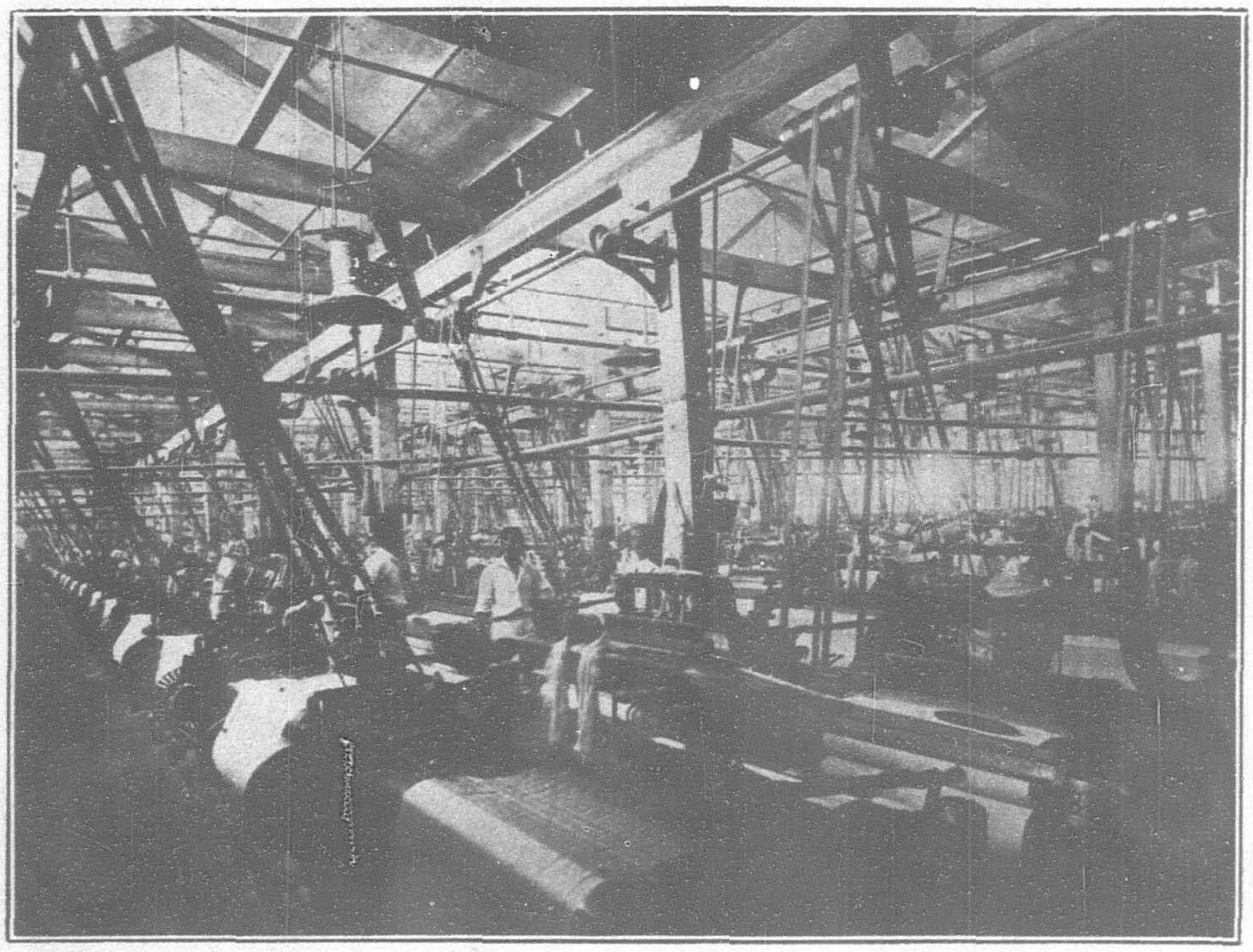
poses without the necessity of shutting down the turbine. This feature is of great importance in a plant using the muddy Whangpoo water for cooling purposes.

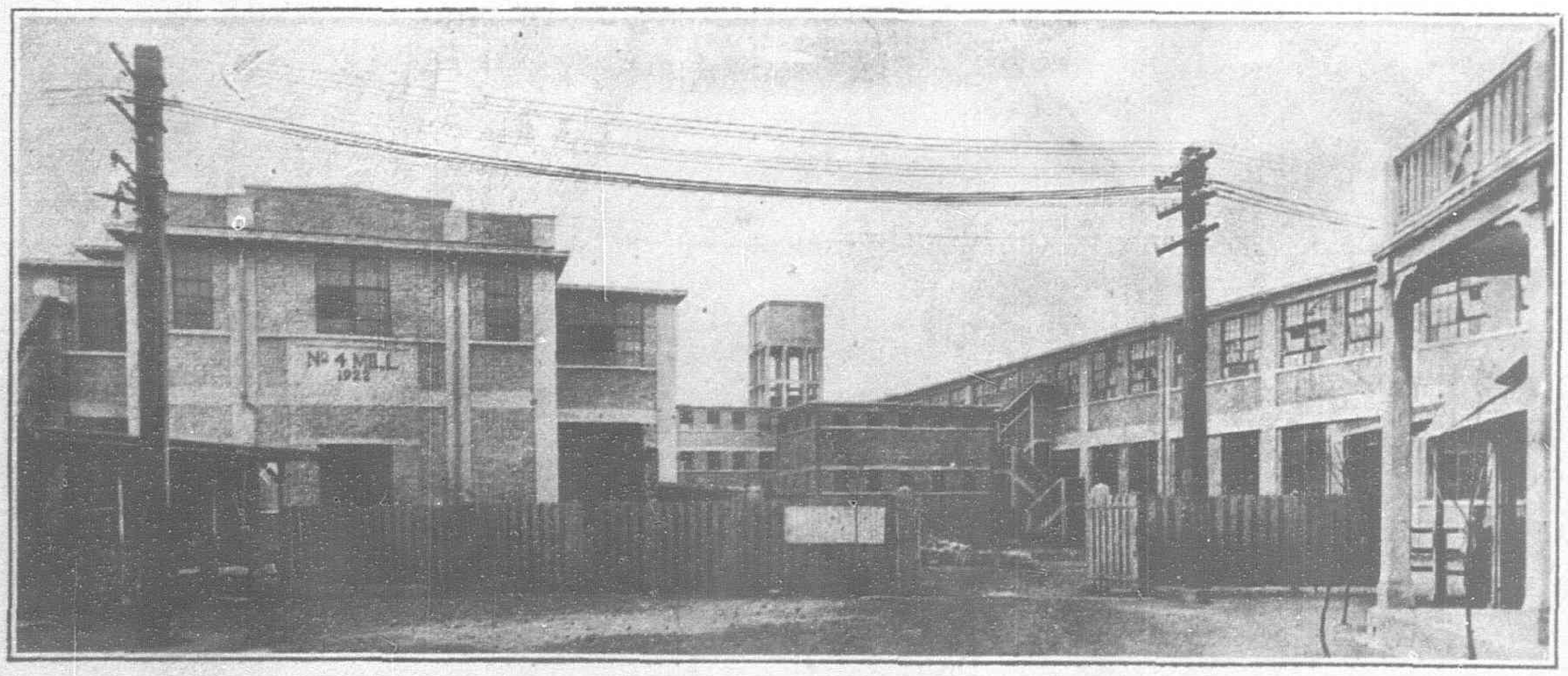
The circulating pump, air and condensate pump are all mounted on a single shaft and are driven by a single three-phase slip-ring motor. All three pumps are ordinary centrifugal pumps, the air being extracted from the condenser by means of a hydraulic ejector. In spite of the bad quality of the water and the large variations of the water level in the Whangpoo making the suction head of the pipe at times as much as 23 feet, the pumps work satisfactorily at all tides and the syphonage of the circulating system is easily maintained, the highest point of the piping being permanently evacuated by connection to the hydraulic ejector.

The switchboard, consisting of two generator panels and several feeder panels for the auxiliary services of the power station and for the large motors installed in the mills, is of standard Brown, Boveri construction for 3,000 volts, the high tension apparatus being mounted directly behind the panels and protected by expanded metal doors. The panels themselves are throughout of metal whereby efficient earthing of the operating gear is assured. The usual instruments are provided for measuring the output and checking the operation of the machinery, all being of the counter-sunk type flush with the surface of the panels making the appearance of the switchboard extremely neat. The regulation of the tension is carried out automatically at all loads by means of a Brown, Boveri quick acting automatic tension regulator so that the switchboard needs absolutely no attendance other than the reclosing of the feeder circuit breakers in case of disconnection by the overload and time limit relays provided on each switch.

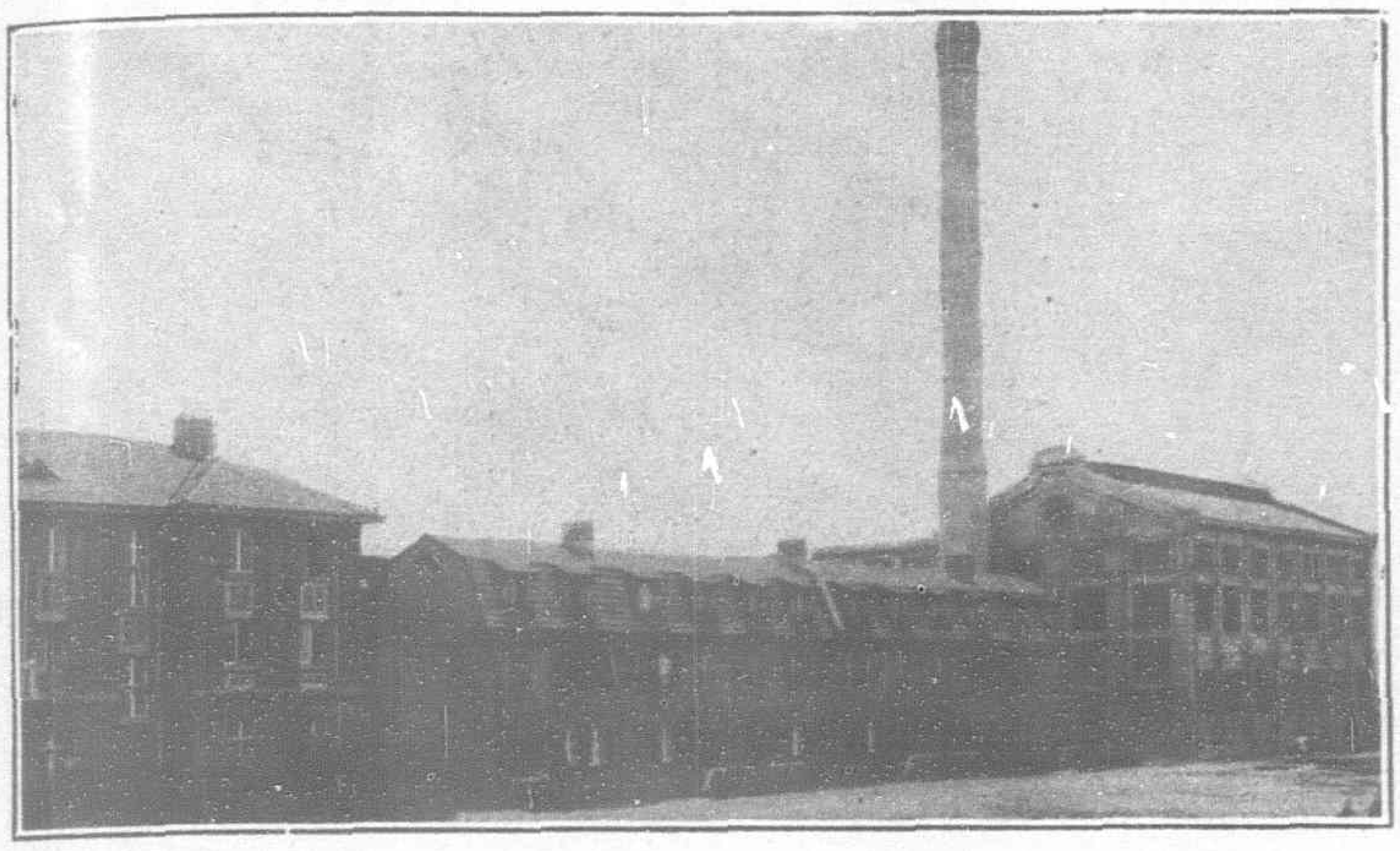
The tests carried out on the turbo generator, which were combined with the evaporation tests of the boilers, where fully successful in every respect, a steam consumption of 11.7-lbs. per kilowatt hour being measured at full load; the temperature rise of the turbo-generator was considerably below the standard figure for such machinery and the overload capacity observed for the turbine being only limited at 2,700 k.w. by the measuring capacity of the instruments available. Both during these tests and in actual industrial service at part loads the oil pressure governing system has shown itself particularly well adapted to the needs of this type of power station, the absence of throttling losses making it possible to run the plant very efficiently even at half load.

In addition to the turbo-generator plant the Pootung mills' electrical equipment includes four 350 horse-power motors made by the Shibaura Engineering Works of Tokyo and three 150 horse-power motors supplied by the Westinghouse International Electric Company. Other small motors up to 50 horse-


Weaving Shed of the Pootung Mill of the Japan-China Spinning and Weaving Co., Ltd. Equipped with 500 Gregson and Monk Looms



Tsaokiatu Mill, Nos. 3 and 4 located on Robison Road, Shanghai



Power Station, Office and Residences of the Pootung Mill

power are by various makers. Electrification of this mill was finished in March this year.

Electricity for the Robison Road mills is supplied by the Shanghai municipal electricity department to 24 motors of 75 horsepower each, made by the Shibaura Engineering Works, as well as to the smaller motors of which many are in use. The Formosa mill also is electrically driven, power being supplied by the Formosa Electricity Co., Ltd , to the two 50 horse-power motors made by the Kawakita Electric Works of Osaka.

The Shanghai and Pootung mills of this company operate almost entirely on Chinese and Indian cotton, using 100,000 piculs of the former and importing 220,000 piculs of the latter annually. The Formosa mill spins 600,000 kin of ramie fiber a year. For these raw materials the company expends some Y.26,000,000 a year. The output in cotton yarn is 80,000 bales marketed under the *Blue Phoenix*, and *Phoenix* chops for 10 to 16 counts, and *Flying Eagle in Cloud* for the 20 counts. The yearly output of yarn is valued at Y.23,500,000. The sheeting output of the Pootung mill is of the 11-pound grade and amounts to 300,000 pieces annually, with a valuation of Y.2,800,000. The ramie yarn aggregates 25,000 bundles valued at Y.750,000. The total valuation of the company's output is therefore about Y.27,050,000. The cotton products are sold in Canton, the Yangtsze valley, Manchuria, Tientsin and the East Indies, while the ramie yarn finds its exclusive market in Japan.

The officers and directors of the company are President ;—M. Kita, Esq. ; Director-in-charge, T. Tanabe, Esq. ; Director and Manager,—K. Ochi, Esq.; Chief-Engineer and Director,—R. Oshima, Esq. ; Directors :—Messrs. K. Kawasaki, T. Ito, S. Hibiya, K. Yano, M. Mochida. Auditors : Messrs. T. Nomura, J. Uenoyama, T. Sone.

Japan's Electrical Power

FOR the first time since the seismic disaster in Japan in September, 1923, the department of communications has issued a report on the conditions of electrical enterprises in this country in July, to be followed by monthly reports. According to the report, there were 834 electric companies, including electric railway companies, on May 31, this year, of which 738 were in operation, 96 bring out of business. The details are :

Companies.	Light and power	Tramways	Light power and tramways
Operating	629	56	53
No operating ..	63	33	—
Total	692	89	53

Compared with December, 1923, four more companies were in business, while three more had ceased operation.

The power generating capacity at the end of May stood at 1,543,472 k.w., of which 1,217,994 k.w., was hydro-electric, and 325,478 k.w., steam generated. Following are the details :

Power plants.		Light and power supply	Electric tramways	Light & power supply & Electric tramways.
Completed	hydro ..	810,510 k.w.	1,674 k.w.	405.810 k.w.
	steam ..	141,404	1,850	182,224
Under construction	hydro ..	499,039	2,779	63,014
	steam ..	161,722	3,125	23,980

Tokyo Telephone Extensions

TELEPHONE subscribers in Tokyo whose instruments represent investments of from Y.1,500 to Y.2,000 need fear no break in the market for two or three years at least, it was stated at the department of communications says the Japan Advirtiser. The recent announcement of an order being sent to England for a quantity of new instruments had raised hopes that the capital of Japan some day might boast an adequate telephone system. The officials in the telephone bureau, however, declare that day remains far in the future.

The order placed with an English company for automatic telephones was for only 24,000 instruments, which will be sufficient merely to restore the Tokyo system to its pre-earthquake basis. The number of subscribers in the capital before the fire was 84,000, and even this number will not be restored until another year and a half has passed.

Approximately 40,000 telephones are in use in the city now and the department of Communications expects to have the number increased to 64,000 by March 31, next year. The new automatic telephones will be installed after that.

While admitting that many thousand more subscribers could be obtained if the telephone system were adequate to accommodate them, the officials in charge state that this fact has nothing to do with the question of increasing the facilities. The insurmountable obstacle is the Diet's unwillingness to approve the appropriation of funds necessary to expand the present system. The telephone business, far from returning a profit to the Government, is a source of loss every year and, as conducted at present, there would be no possibility of recovering the cost of installation from subscribers' fees. This situation exists despite the fact that a basis charge of Y.40 a year is made for each telephone and each call is charged at three sen. A larger system and a greater number of subscribers would mean merely a greater deficit, which the government in its present circumstances feels would be an unjustified burden.

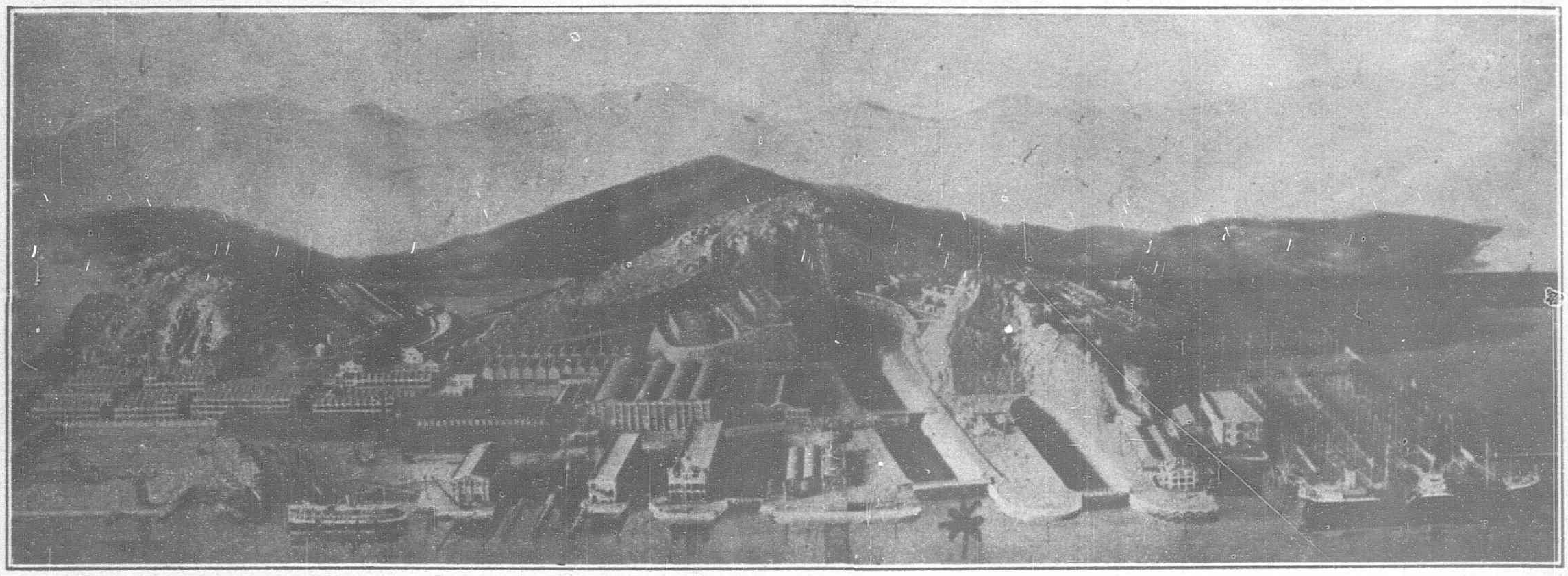
Brokers' Prospects Good.

For several years more, then, the telephone brokers will thrive on the misfortunes of companies to whom the telephone is an essential part of business equipment.

Arnhold Bros., Win Contract

ACCORDING to a Mukden dispatch, there has been considerable heartburning over the recent awards for railway tenders which were put out some months ago. Among other things, bids were asked for machinery for the Koupangtze workshops and twenty miles of rails for a branch railway running to a promising coal mine near Chingchow. Parenthetically it may be remarked that the building of this railway will make the Hulutao harbor scheme essential for the export of coal which cannot be all consumed locally. The feature of the awards has been the overwhelming victory of Belgian steel which has under-cut even American steel so badly that it had not a look-in. Messrs. Arnhold Bros., representing British manufacturers as well as Belgian, took the cream of the contracts on Belgian accounts as no other prices were competing except some British power plant prices.

The Jardine Engineering Corporation secured the sleeper contract in a last minute tender, everything going to show that the Manchurian authorities have had the utmost value for their money ; contractors having to work at very fine rates indeed to have a chance. The strong position of the Belgian manufacturers is ascribed to the fact that iron ore and coking coal are alongside the works and that every known automatic device has been put in since the war with government help making the Belgian position impregnable. Meanwhile the high power cable-cars give promise of being in operation here before they are in Peking. The rails have all arrived and the German contractors are pushing on with their work as fast as possible.



New Graving Dock, 1,200 Feet Long, to be Largest in World, having Double Efficiency due to its Division into Two Units, if Need be, to Dock Small Craft

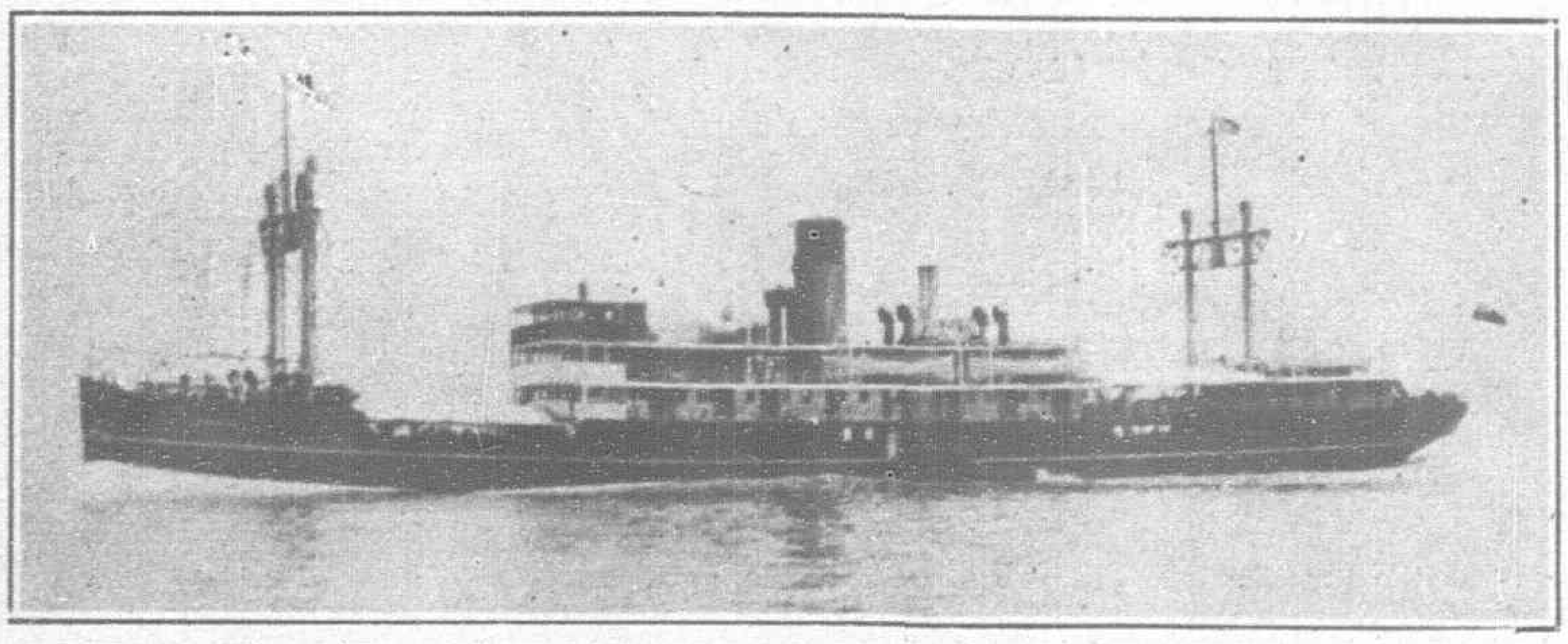
Hongkong and Whampoa Dock Exhibits Model at Wembley*

ONE of the most admired features of the Hongkong exhibit at the British exhibition at Wembley was a model showing the various component parts of the Hongkong and Whampoa Dock which is reputed to contain the largest graving dock in the world. This was especially interesting to the British public in proving than even were the Singapore naval base scheme to come to naught, the Empire still would have a dock in the Far East capable of taking the largest battleship afloat not only for minor repairs but major ones as well. This new dock at the Kowloon plant of the company is 1,200 feet long with a minimum breadth of 128 feet, large enough to take the biggest liner or the most powerful battleship afloat.

The dock is not designed only for the leviathans of the sea, but is arranged for docking much smaller vessels in case no large applicant appears in the offing. This is accomplished by a division lock which virtually cuts the huge graving dock in two, giving an inner dock of 710 feet for the larger vessels that ply the Far Eastern seas, with an outer dock of 470 feet in length for the smaller fry, and few of the China coasters exceed this length. With this graving dock in full operation as it soon will be, the ship repairing facilities of the Hongkong and Whampoa Dock Company will be almost doubled and make it the premier installation in the Far East for docking any steamer that may require such service in the next ten years.

The plant of the Hongkong and Whampoa Dock Co., Ltd., is the growth of some 60 years of endeavor and the policy of the company always has been to keep its facilities ahead of the maximum possible requirements. To this end the dock is expending no less than $5,000,000 to prepare for any future call upon its resources. Aside from the huge graving dock, the company operates three smaller docks, the largest of which can take ships up to 700 feet in length and two slipways with a maximum length for No. 1 of 650 feet, together with the Cosmopolitan dock, and the Aberdeen docks on the Island of Hongkong, comprising the Hope and Lamont docks.

In the design of these docks, the greatest possible efficiency is attained by adequate pumping equipment which has been greatly augmented to meet the requirements of the new graving dock. The apparatus now installed is expected to empty it in some three and one-half hours. The pumps are operated by 2,200 volt, 3 phase, 60 cycle motors of 550 h.p. for each of the five 42 inch twin parallel type centrifugal pumps. Other entities of the dock's equipment are on like scale and no effort has been spared to be prepared for any emergency in building or repair of ships, so that machine shops, foundries, boiler shops and wood working installations are along the most modern lines. During its 60 years of experience and growth, the Hongkong and Whampoa Dock Co., Ltd., has solved many problems of ship repair and construction, the latest of its launchings being the steamer Lienshing, built to the order of the Indo-China Steam Navigation Company, Ltd., for the Shanghai-Tientsin run.



S.S. Lienshing, Built by Hongkong and Whampoa Dock Co., Ltd.

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*Full description of the Hongkong and Whampoa Dock Co., Ltd., will be found on page 233 of the May, 1924, issue of THE FAR EASTERN REVIEW.

Bethlehem Steel Company's Mayari Pigiron

THE Bethlehem Steel Company has issued an attractive booklet on its nickel chromium iron called Mayari pigiron, the publication being noteworthy from a practical as well as a scientific standpoint. It embodies the work of Dr. Richard Moldenke on this particular alloy iron as reported by him to the American Institute of mining and metallurgical engineers on the scientific side. It also seeks to familiarise the foundryman with the details of working this new product. Mayari pigiron is made with a considerable range of silicon so that it may serve for white iron castings, chilled rolls, etc., as well as for making soft machineable castings. It is supplied with silicon content ranging from a quarter of one per cent., to more than two per cent., while nickel runs from 80 points to 1.25 per cent., and chromium from 1.60 to 2.50 per cent. Phosphorus is kept below ten points and sulphur below five as a maximum.

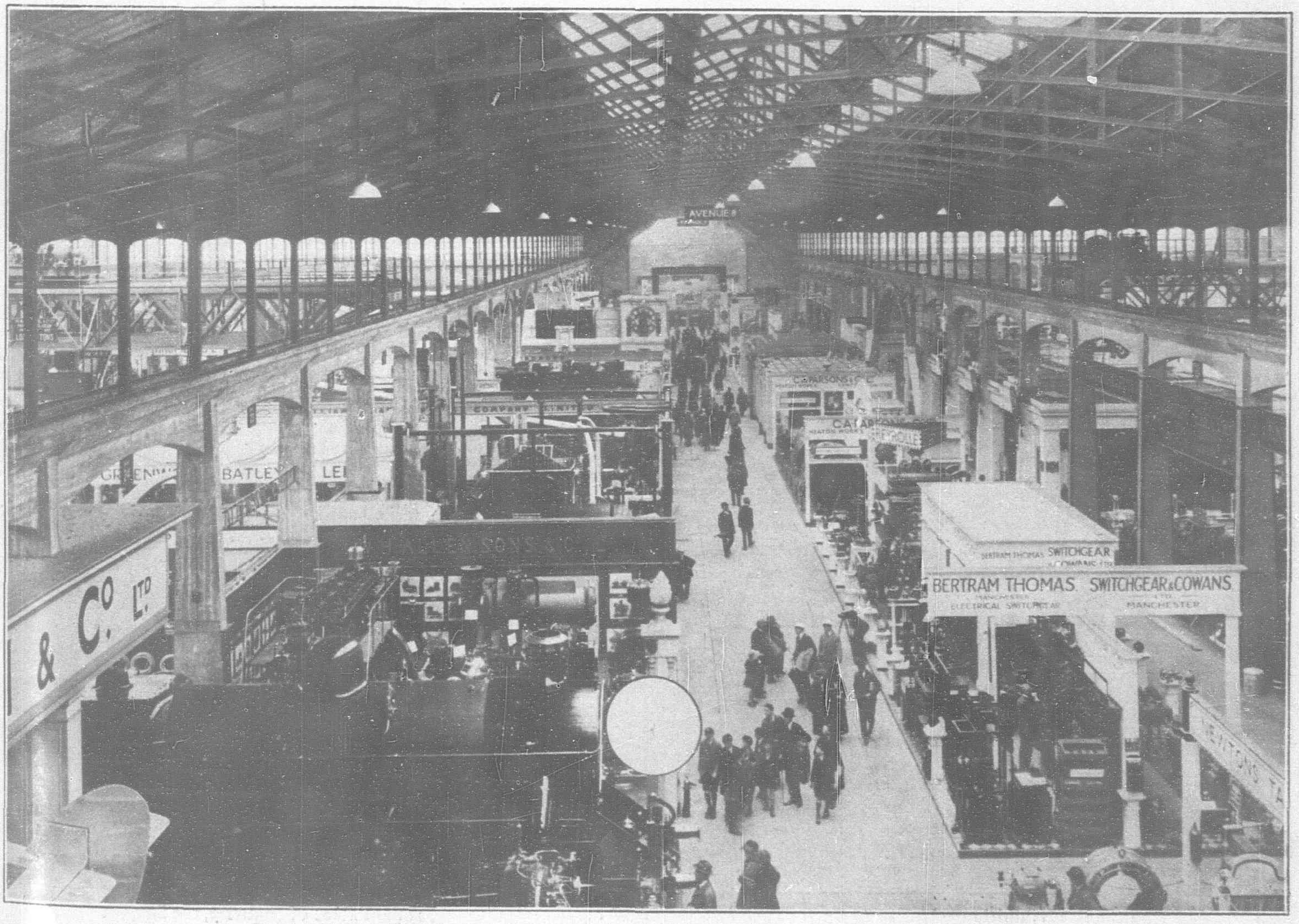
The British Empire Exhibition

Eleven Acres Devoted to Engineering

THE British empire exhibition recently inaugurated and opened at Wembley Park, London, by King George, to remain open for six months, perhaps longer, is of the utmost importance to the engineering world. Before reviewing the main features of the engineering section, in order to give readers some idea of the vastness of the exhibition, a few general details will be of interest.

The total area covered is 240 acres, the buildings and exhibits costing over 120 million dollars, while it is confidently anticipated that a further $100,000,000 will be spent by the thirty million visitors who, it is conservatively estimated, will attend this exhibition (during the first few days after opening, when not by any means in running order, it attracted a steady 100,000 daily). Five railways run into the grounds and 15 miles of roads traverse the exhibition. The world's largest stadium with seating accommodation for 125,000 spectators, takes up one corner of the grounds. In its construction 1,500,000 rivets have been used. The largest bandstand has an enclosure of 10,000 seats, 3,000 more being available outside. The amusement park which covers

Palace of Engineering at the British Empire Exhibition Covering an Area of over Eleven Acres



British Empire Exhibition—Portion of the Electrical Section in the Palace of Engineering

46 acres, has a theatre and dance hall said to be twice the size of any other in existence. Over two million lights are used for illuminating purposes, and 54 restaurants—all under one management—cater for the needs of the inner man.

The two largest buildings are known as the palace of engineering and the palace of industry. The former covers an area of 596,000 sq. ft. and houses over 11 acres of solid machinery exhibits. It is the largest ferro-concrete building in the world and in it are five railway bays for the transhipment of exhibits directly to and from their beds. The floor of this building is concreted to a depth of four inches at a cost of $100,000.

Engineering being the premier industry of this country, the design of the palace of engineering has been carried out with the idea of its being a monument worthy of the craft. This ambitious plan has fully developed, with the result that under one roof is shown every example of the skill of the country's engineers.

In order to avoid confusion, the engineering exhibits have been divided into three main sections—general engineering, electrical engineering and transport. In all these sections, which cover the entire field, there is gathered together the most representative display of engineering products the world has yet seen. The exhibits range from some weighing over 150 tons each down to the most delicate testing intruments that have ever been produced.

The general engineering section, which has been organized by the British engineers' association, and which occupies nearly half of the huge building, shows every phase of the craft from the molten metal stage to the finished machine, tool, or engine. More than four hundred firms are exhibiting in this section. Foundry practice is represented by small cupolas heated by gas and coke, by moulding machines and other appliances employed in the smelting and casting of metals. Structural engineering is illustrated in a wide range of activities, together with the operation of pneumatic tools. Huge forgings, castings, and stampings reveal the class of work that is undertaken in the modern engineering shop, while groups of machine tools demonstrate how the rough materials from the foundry, the steam hammer, the hydraulic press, and the smith are turned, faced, drilled, and shaped into some part of a complicated machine.

In each bay of the palace there is a huge overhead electric traveling crane, capable of lifting 25-ton loads. Jib cranes, locomotive cranes, hoists, and other lifting gear are represented in great variety, as well as types of mechanical excavators and steam shovels. Coal has its proper and prominent place. There is a complete show of colliery equipment, including winding-engines, coal-cutters, pit props of steel and wood, tubs for conveying coal from the working face, pumps, ventilating fans, and every form of machine used in a modern coal mine. Additional to this exposition, although out of the palace of engineering, there is a full-sized model colliery, with a shaft down which visitors are taken, leading to underground workings in which electric coal cutters are shown at work, pumps running to keep the workings clear of water, fans for supplying fresh air, tubs filled with coal and running on a miniature railway with pit ponies to pull them. Above ground is shown the huge pit-head gear and winding engine for bringing the coal to the surface, washing and screening machines, life-saving apparatus, and medical appliances for emergency use. The cost of constructing this mine alone approximated half a million dollars.

One of the most striking displays in the palace of engineering takes the form of the deck, bridge, and upper works of a modern passenger steamship, showing the intricate mechanism that controls the mass of machinery needed for the vessel's propulsion, for illumination, heat and ventilation, operation of elevators, pumps, capstans, etc., for the maintenance of wireless communication, and for ensuring the safety of the passengers and crew.

There is a life-like representation of divers at work under water. These men wear the latest types of dress and helmet and are equipped with telephones which permit of their holding a conversation with the men many fathoms above them on the salvage vessel.

British Empire Exhibition—An End of One of the Thirteen Huge Avenues which Compose the Palace of Industry, the Largest Ferro-Concrete Building in the World

The great engines of modern ocean liners are exhibited in this section along with some of the most modern and up-to-date boilers using oil for fuel. Boilers of all patterns from the well-tried Lancashire type to the latest form of water tubes, super-heater, and mechanical stoker are represented. Some of these are opened out in order that their construction may be examined, while others are used in the power house and elsewhere. Marine engines, of Diesel and semi-Diesel type, and steam turbines are exhibited in a wealth of variety and power, together with all forms of ship-control apparatus. Every type of machine tool is shown and modern methods of handling goods are illustrated in conveyors, transporters, elevators, cranes, steam shovels and grabs. Agricultural machinery and implements are demonstrated by leading manufacturers, and textile machinery includes the most up-to-date looms.

As the body responsible for this section, the British engineers, association has made its display complete by the inclusion of facilities for the reception of overseas visitors. A special staff is in attendance in the B.E.A. bureau to answer inquiries concerning the trade and the exhibits. Interpreters, technical engineers, and messengers are available, and every effort is made to make the visitors comfortable.

The science of engineering as applied to military purposes is represented by actual specimens of big armor-piercing shells and the guns that fire them, by pieces of 14-inch armor-plate used to protect battleships from gunfire. Howitzers, field guns, anti-aircraft guns, and searchlight equipments also have a place in this wonderful demonstration. Probably the most notable military exhibits are the enormous 16-inch naval gun, the breech mechanism of which is shown in operation, and the vast array of aircraft. The naval interest is also contributed by large scale models of battleships, destroyers and submarines, the information which they present being added to by life-size sections.

The research section is provided by the national physical laboratory and includes departments devoted to physics, metrology, engineering, metallurgy, and the William Froude national tank. The physics department shows in operation a modern electric furnace with its high temperature pyrometer, and conducts X-ray examinations into industrial materials in search for faulty workmanship and to illustrate the atomic structure of pure metals, alloys, and compounds. Hygrometers, of various types, for investigating humidities are displayed, together with a special arc furnace used for highly important research work on arcs at high pressure. An instrument which shows the finest thread as large as a ship's cable is shown in the metrology department, which covers all methods of measuring.

The engineering department presents machines for testing the strength and efficiency of chains, gears, and bearings, and a Wohler fatigue-testing machine, which, aided by its small mirror, indicates when a metal has reached the limit of its endurance. Examples of castings, wrought alloys, test pieces, forgings, and special alloys are shown to illustrate the effects of heat treatment and their resistance to fatigue ; investigatory methods are described and typical failures shown in the metallurgy department, which also includes many interesting specimens demonstrating the behavior of mild steel under cutting tools. Electric furnace controls are displayed in operation.

A wax model of a ship as employed for tests draws attention to the William Froude national tank, which predicts the resistance of given forms of ships, the power necessary to propel them, and any other of their qualities on which information is desired. Altogether the national physical laboratory's exhibit is a wonder-provoking demonstration of the amount of research and mathematical precision which lies hidden behind the finished products of the engineering industry.

The electrical engineering section occupies a floor space of about 3½ acres in the palace. It presents a striking demonstration of the way in which electricity has come into use in every phase of industrial and domestic life. The development in electrical engineering has been rapid and continuous, and in this section can be seen the latest achievements in turbo-alternator design, in switchgear, transformers, storage batteries and plant used in connection with the generation, conservation, and distribution of electrical energy on an enormous scale. The practical application of electricity for the purposes of the British empire exhibition is shown. On the north side of the section is a completely equipped boiler house and power station of 6,000 h.p., together with a sub-station. In the boiler house is shown how the coal is handled mechanically and conveyed to a large bunker on the roof of the building. From here it passes to the boilers, which are stoked mechanically, and measuring appliances are installed by which the attendant can see the amount of coal which is being used, the temperatures at various parts of the boiler, and the amount of steam which is being supplied to the power station. He can thus tell at a glance all that is happening in the boiler house.

In the power station by the side of the boiler house are installed three steam turbines with direct coupled generators, and below this are fixed the condensers by which the steam, after being used in the turbines, is condensed and conveyed to the boiler to be used again. Along one side of the power station is fixed a switchboard through which the electrical energy is supplied to the entire exhibition. The energy supplied from the switchboard not being of the right voltage for most purposes of the exhibition, sub-stations and transformer stations are installed in various parts of the grounds. One of the most interesting of these sub-stations—near the power station itself—is arranged for converting alternating current as supplied by the generators to direct current, largely for use in the great amusement park.

Among the larger applications of electric power those of particular interest are the electric appliances for the driving of trains and tramways and those for factory use. All these are well represented. There are exhibits of railway motors and control gear, and of large railway coaches electrically equipped such as those used in the traffic systems of large cities.

In order to show the many examples of the usefulness of electricity in the home, an entirely novel " electric house " has been constructed and is so arranged as to permit large crowds to view at leisure and in comfort all the usual and practical applications of electricity for domestic use. A restful " Electric Rendezvous," where one can obtain any information desired concerning electrical facilities in the districts in which they reside, and find accommodation for rest or arrange meetings with friends, is at the service of all interested in electricity.

In addition, in another pavilion there is arranged an exhibit showing the use of electricity in agriculture, farm and dairy work, showing electrical haymaking without sunshine, electric milkers, and numerous other exhibits of special interest to farmers.

The transport section, as an important branch of the engineering industry, has a large proportion of the palace of engineering in which to display the wonders of the progress which has been made since the early days of horse and wind propulsion. The section is subdivided into four subsidiary sections—railway transport, land transport, sea transport, and motor transport.

In the railway sub-section, the famous railways of the country display their latest achievements, and associated with them are the prominent makers of rolling stock and other railway and tramway appliances. The whole of railway history is summed up in one corner of the section, where, side by side, are shown a modern express engine weighing 150 tons, costing $70,000, and the first steam engine to run over any railroad. The latter is called locomotion No. 1, and was built by Robert Stevenson. It *preceded* the famous Rocket and made its first journey over the Stockton & Darlington line at a speed of eight miles an hour. The engine weighs six and a half tons and is in a remarkable state of preservation. The modern express engine was brought all the way from Doncaster (140 miles distant) to its resting place in the exposition without once leaving the metals.

Additional to the motive power of the trains are actual examples of the latest types of passenger coaches, dining cars, and freight wagons. Some of these are built entirely of steel to eliminate the fire danger, the steelwork being disguised to resemble painted woodwork. Modern pullman coaches and up-to-date signalling methods help to complete the railway display, while any features which cannot be displayed are shown in a commodious special picture theatre. The general land and factory sub-section contains a display by well-known firms of carriers and also exhibits relating to factory equipment and communication.

The exhibits of the water transport sub-section are contributed by leading steamship companies and associations connected with various important shipping ports. The White Star line are showing models of two of their most famous liners, the *Majestic*, said to be the largest steamer in the world, and the *Homeric*, the largest twin-screw steamer in the world. The R.M.S.P. Co. are exhibiting several large models of their vessels, including the *Arcadian*, the largest steamer in the world devoted solely to pleasure cruising, and a huge case containing water-line models showing the history of the company's ships from its inauguration to the present day. Side by side with the *Forth*, of 1,900 tons, launched in 1841, is the *Ohio*, the company's largest vessel, of 19,000 tons.

The ports of the United Kingdom are represented by exhibits from the port of London authority and the Mersey (Liverpool) docks and harbors board. Designed by Sir Edward Lutyens, the noted architect responsible for the new port of London authority building (just erected at a cost of $22,500,000 and said to be the finest building in London), the stand which houses the authority's exhibits is in keeping with the magnificent parent building. It consists of two halls, the exhibition hall and the movie hall. In the former is shown a valuable and unique collection of old prints and paintings depicting the life associated with the port of London in the 17th, 18th and 19th centuries. On the floor of the hall are models of London's largest and most modern docks. Statistics of the tremendous volume of traffic and merchandise handled through these docks are shown on the largest multiplex signs in the country. In the movie hall is shown a 3,000-foot film depicting every phase of waterfront activity.

Liverpool, as the port handling the greatest export trade of any English port, has made a very interesting addition to the exhibition by a working model to scale of the port of Liverpool, illustrating the immense facilities offered to the shipper by the 37 miles of quays of the Mersey port.

Perhaps one of the most interesting of the transport sections is that of motor transport. Here are shown the latest examples of pleasure and commercial vehicles, representing the best that efficient craftmanship and design can produce. Steam road rollers, motor rollers, traction engines, agricultural and other tractors—all these are here. All exhibitors in this section have been strictly rationed as to space in order to insure that it is thoroughly representative of the whole industry. Rarely is more than one model of any make on view, but exhibitors are permitted to change their exhibit monthly. This is an entirely new feature of automobile displays which will undoubtedly be much considered by organizers of future fairs. The motor and cycle section illustrates every application of the gas motor, aero engine, motor truck, steam, electric, and gasoline vehicles, tires, accessories, and auto bodywork. The products of some 200 manufacturers are represented.

It is impossible to enumerate all that this section of transport displays, but the founders of the exhibition have one principal aim—the capture of foreign trade. The display covers an area of 50,000 square feet.

The ambitious plan of the organizers of the palace of engineering to show every branch of the industry under one roof has surely been achieved, and the founders, as well as the eight hundred exhibitors, have every reason to be proud of the result. It is as they intended it should be—the most complete and comprehensive exposition of the engineering industry ever assembled under one roof.

Engineering Press at Wembley

ENGINEERING Press representatives at the armour-clad Switchgear Exhibit of Messrs. A. Reyrolle & Co., Ltd., Palace of Engineering, Wembley Exhibition, Friday, May 30. A description of the gear will appear in an early issue.

Parson's Turbine Exhibit at Wembley

AMONGST the many and wonderful exhibits to be seen at the empire exhibition at Wembley, perhaps one of the most interesting is that of Messrs. C. A. Parsons & Co., Ltd.

The first steam turbine which was of any practical use was constructed by the Hon. Sir Charles A. Parsons at Gateshead-on-Tyne in the year 1884, and some idea of the remarkable strides which have been made in turbine design and construction since those early days, can be obtained by a visit to their stand at the exhibition.

The principal exhibit is a 12,000 k.w. 3,000 r.p.m. tandem turbo-alternator and exciter, designed for railway traction. (The plant is one of the five sets with surface condensers constructed during 1923-24 for the Union of South Africa electricity supply commission. These sets will be erected in the new power station at Colenso, Natal, for the electrification of the railway between Glencoe and Pietermaritsburg. Each set is capable of supporting an overload momentarily of 20,000 k.w. and is similar in design to the 15,000 k.w. 3,000 r.p.m. plants recently exported by the Parsons Company to the Victoria electricity commission, Australia, for the electrification of the Melbourne Suburban Railways).

Another exhibit of special interest is a $\frac{1}{12}$ scale model of a 50,000 k.w. turbo-alternator and condensing plant which is now nearing completion at Heaton Works, and will be erected in the new 500,000 k.w. station at Crawford Avenue, Chicago, To show the layout of the plant in relation to the engine room, the model includes basement, walls, roof and crane. Some idea of the immensity of the station will be gained from the fact that the crane-rail span is 122-ft., and the height from basement to the apex of the roof is 113 feet. The model is 9-ft. 5-in. high, 7-ft. 10-in. wide and 11-ft. 3-in. long This plant is the second set exported by the Parsons Company to Chicago, a 25,000 k.w. tandem turbo-alternator having been erected in the " Fisk Street Station " in 1913. Messrs. G. & J. Weir supplied the models of the boiler—and condensing plant—auxiliaries, which they are manufacturing.

A second model—also to $\frac{1}{12}$ scale should prove of interest to mill owners. It shows a geared turbine power installation in a Lancashire cotton mill. The actual plant from which the model was made has been in operation for over ten years.

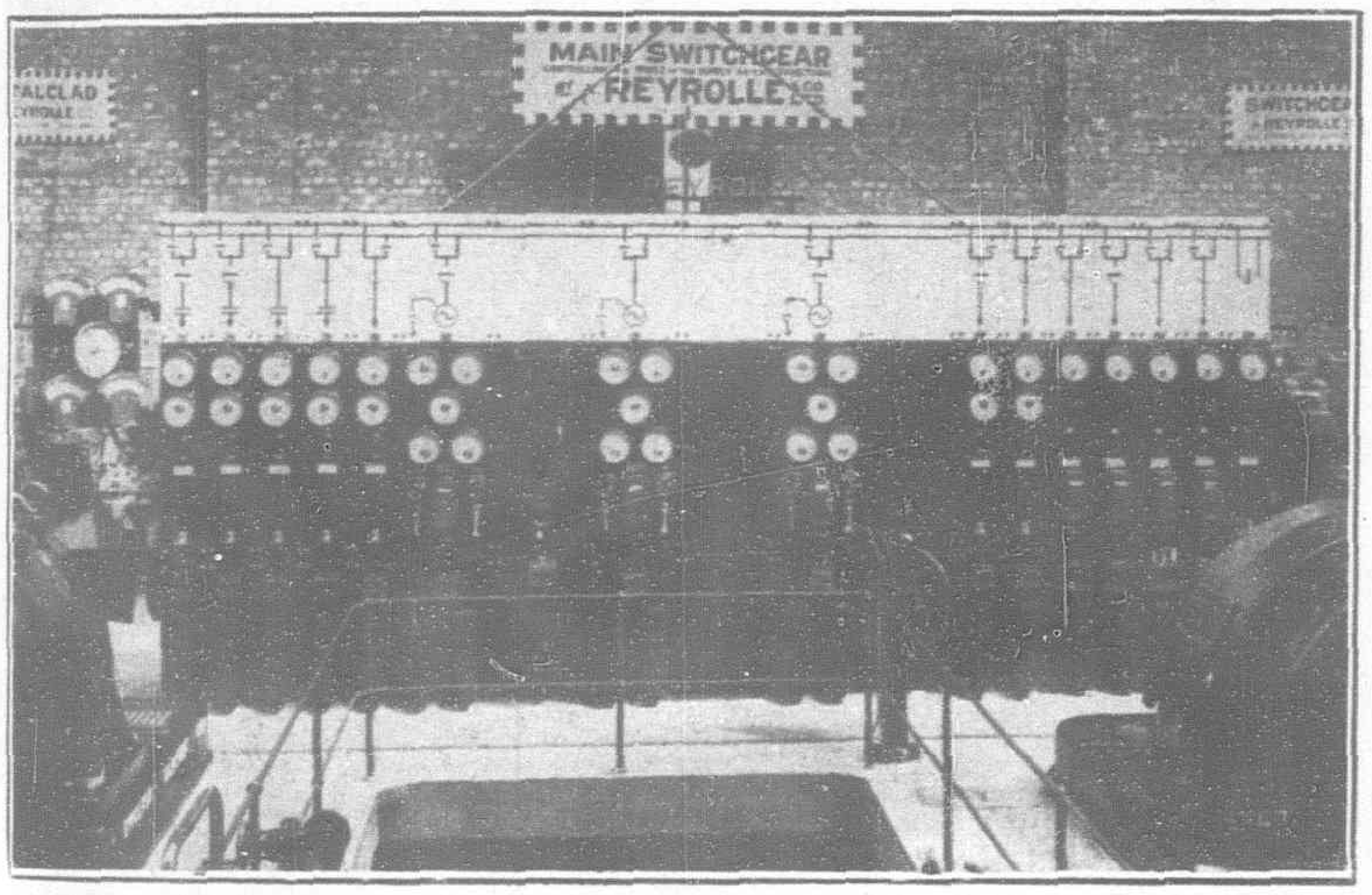
Of considerable historical interest is another exhibit which is a small $\frac{1}{2}$ kilowatt ($\frac{2}{3}$ horse power) direct coupled turbo-dynamo, running under steam at about 9,000 r.p.m. It was built some thirty years ago, and is of similar type to the first Parsons machine of 1884 which now rests in the museum of science and technology at South Kensington. The turbine is arranged on the double flow principle; and the speed is regulated by a combined mechanically and electrically operated governing mechanism of great ingenuity.

Reyrolle in Control

Metal Clad Switchgear at British Empire Exhibition

The design of the power station, which is situated in a bay of the Palace of Engineering and supplies the whole of the British Empire Exhibition, has been given much careful consideration in order that when complete it should be typical of first class British practice. The resulting installation has amply fulfilled the aims of the engineers. The general impression obtained is of a compact design, readily accessible and with all the essential apparatus and control equipment easily visible to the operating Engineer. This is no less the case with the main switchboard than with the turbo alternators themselves. As an example of up-to-date British practice it is a particularly happy choice on the part of those responsible for the design of the power station.

The present tendency in power station design is undoubtedly towards increased reliability and the safety of the operators and the metalclad designs typify this in their fullest sense. The principle of metalcladding is not a new one; it originated in the year 1908 and was immediately adopted by Messrs. A. Reyrolle & Co., Ltd., as the basic principle of safe switchgear design upon which they pioneered their now universally known metalclad switchgear. This design was very early appreciated and extensively used by the large power supply authorities who recognised at once its effect in simplifying and cheapening substation design, while effecting a still greater improvement in the safety of the whole system.



Wembley Power Station Control Board Supplied by A Reyrolle & Co., Ltd.

The Exhibition power station switchboard comprises fifteen panels with a normal rupturing capacity of 250,000 K.V.A. It is arranged along a wall on a turbine floor in full view of the public gallery. It is electrically operated from a control board placed a few feet in front of it and the whole arrangement is one of outstanding robustness and simplicity, the complete accessibility and the small space occupied being particularly noticeable. The system of supply is 3 phase, 3,000 volts, 50 cycles per second and the circuits controlled are:—

Three 1,500 K.W. turbo alternators with full metering, synchronising and indicating equipment, Merz-Price discriminating fault protection and field suppression and neutral earthing devices; Two 500 K.W. rotary converter, and four 500/1,000 K.V.A. transformer panels with inverse time limit overload protection; Four outgoing feeders with definite time limit overload protection; One incoming feeder with inverse time limit overload protection; One busbar coupling panel.

There is no special masonry construction whatever and any portion of the complete metalclad board could be touched by the general public or a contingent from an infant school, without damage to themselves. An automatic diagram above the main control board indicates the operation of every panel in detail, all indicators being electrically operated by auxiliary switches on the switch panels.

The robust construction and neatness of finish and assembly of this switchgear is typical of Messrs A. Reyrolle & Co., Ltd.'s standard productions and is reflected throughout the exhibits on their Stand and also on the control equipment for the "Peebles-Reyrolle Automatic Service" exhibit on Messrs. Peebles Stand, which they also designed and manufactured.

The Edgar Allen & Co., Ltd.

Comprehensive Exhibit at Wembley

ONE of the most comprehensive exhibits at the British Empire Exhibition at Wembley is that of the Edgar Allen & Co., Ltd., as it exemplifies to a great degree the slogan of the firm "the right steel for every tool," the phrase which greets every visitor to the stand. The exhibits while many in number are arranged to good advantage considering that they include several items of mining machinery, the portable stag ore crusher with its revolving screen, and, the heavy stag crushing rolls being especially interesting to mine operators. The exhibit also includes the stag ball mill with its perforated chrome steel grinding plates that deliver the material ground to any degree of fineness through intermediate and outer screens into the tapered bottom of the outer casing of the mill.

Another machine of interest is the stag pulverizing cylinder for batch grinding of ores or minerals in either the wet or dry state. This type of mill is lined with steel and the grinding material is either small steel balls, special flint pebbles or porcelain balls depending upon the character of material to be treated. Nearby is a full sized model of the Imperial automatic measurer used for the rapid measurement of coal, sand, lime and other materials. This machine has rotary valves at top and bottom so arranged that when the top one is opened the bottom is closed then when the measuring chamber of which there are two, is filled, the bottom valve opens, discharging the material from one chamber while the other is filling.

Something like 100 kinds of materials that have been crushed by the machines on exhibition are shown, ranging in hardness from charcoal to hard chrome iron ore.

The Edgar Allen railway department is of great interest as it includes some switches made of the celebrated manganese steel that while it is so ductile it can be bent cold without fear of breaking and so hard that no tool has been found that will machine them. All shaping has to be done with intricate grinding machines. As it was manifestly impossible to show the completed track work in the limited space, special photographs were taken to exemplify some of the more intricate of the company's special installations. Others are shown by reproduction of the original drawings.

It would take much greater space than is at our disposal barely to enumerate the other exhibits of the Edgar Allen Company. Steel for tools in every grade from the high-speed kind that will cut when red hot to the slower type steels that take huge shavings off cast iron. Among the more remarkable saws exhibited, is one without teeth. It is 46 inches in diameter and finished with a chisel face. It operates as a friction disc and eats its way through the metal by revolving at a speed of 25,000 feet a minute. Other saws to cut almost every variety of material, including one for hot metal, are shown. Nor are the later, alloy steels omitted, since the motorcar steel department has nickel steel, chrome-vanadium and nickel—chrome steels especially designed for the heavy stresses of modern motor vehicles.

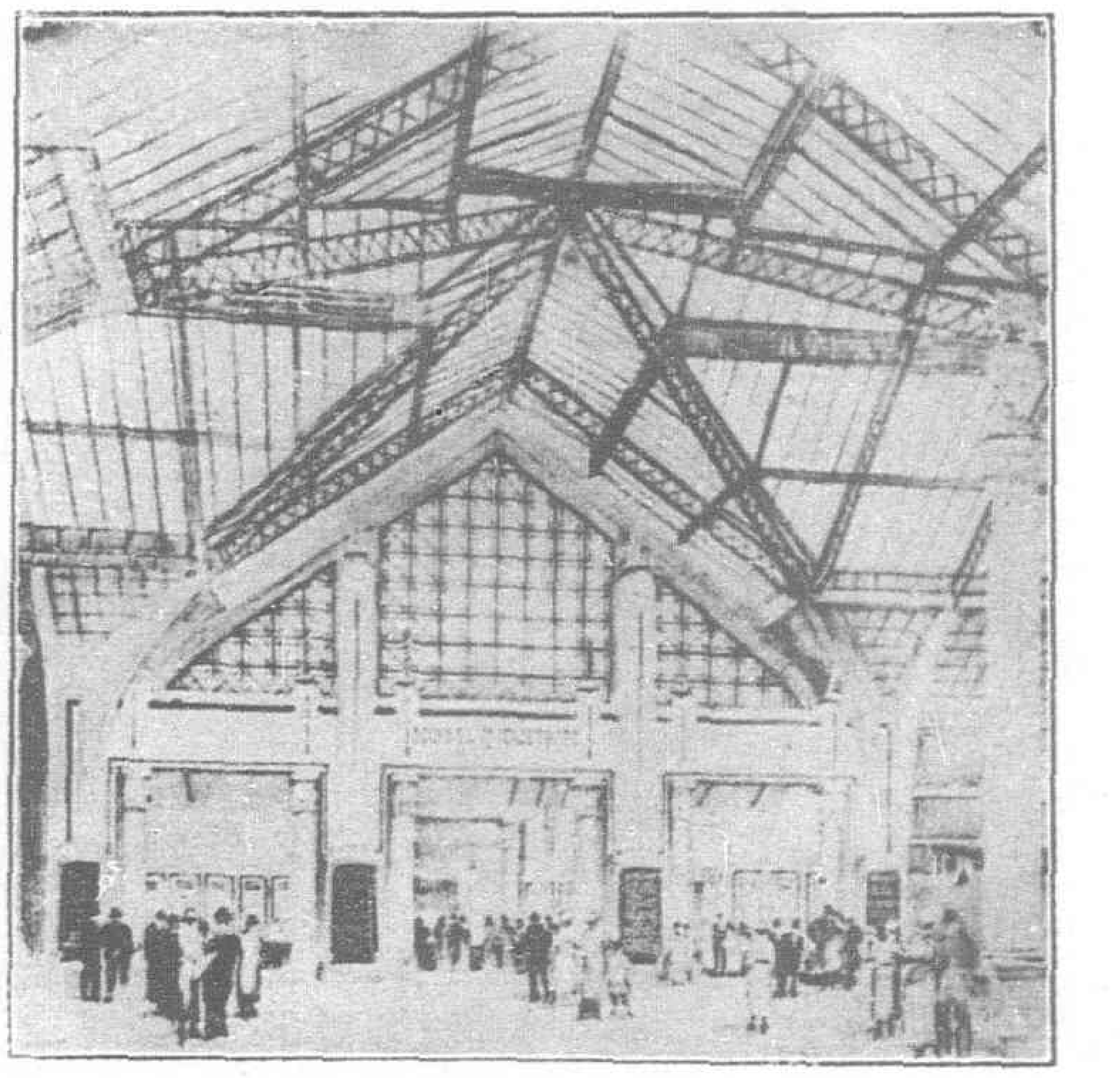
Intricate steel castings and products of the forge and press department are also included in such variety that one marvels at the ingenuity of the foundrymen. One of these is a cast steel disc for an oil-cake cutter which is remarkable for its diamond shaped teeth, each of which must have a perfectly sharp point. Unless the points of the 52 teeth are like needles, the whole casting is wasted. Hot steel and an infinite attention to moulding details bring about the desired result, which, however, was not easily attained even by the firm's skilled foundrymen. Cast steel crankshafts also are shown as beautiful specimens of the skill of the foundry but Messrs. Edgar Allen and Co., recommend rather that only forged and not cast crankshafts should be used.

Taken all in all, the exhibit is one that illuminates not only the varied uses of "Stag" brand steel, but the almost limitless variety of the materials and the thousand-and-one applications that can be made of this firm's product. It is also a liberal education in the advancement in the use of steel that has come about since the day, only a few years ago, when "high-carbon" and "low-carbon" were about the only varieties available for the selective genius of the engineer who now can choose "the right steel for every tool" from the products of the Edgar Allen & Co., Ltd.

Nobel Industries Limited at Wembley

Its Influence in Commerce Reconstruction Work the Effect on Every-day Life

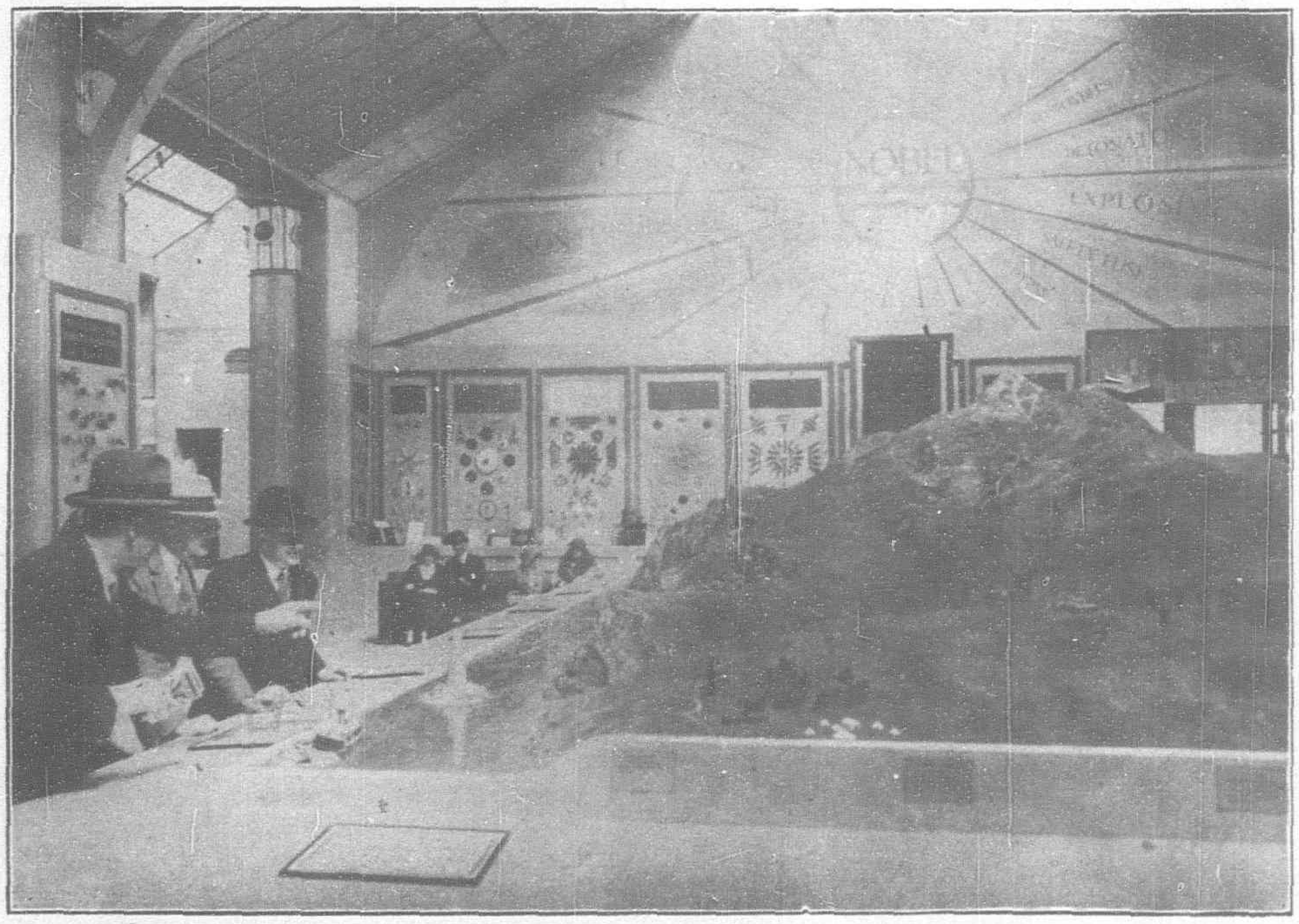
NOBEL Industries, Limited was formed in 1918 by the amalgamation of British manufacturers of explosives and accessories, ammunition, metals, and allied industries, and have published a guide book designed to afford an insight into their exhibit —the Nobel bay—in section " E " of the palace of industry at the British empire exhibition. The following is a summary:



The Nobel Pavilion

The exhibit embraces numerous types of explosives and gun-powders used for industrial purposes; propellent and disruptive explosives, brass cartridge cases, fuzes for shells, small arm ammunition, sporting cartridges, metal products in a raw and in a semi-manufactured condition, with examples of the physical tests imposed on them; nails, gas mantles, lamps, new collodion products in the form of paints and varnishes, Sunbeam motor bicycles and ordinary bicycles, radiators, carburettors, motor accessories, welding plant, leather cloth for all kinds of upholstery purposes, and many applications of the famous lightning fastener. Samples of the fertilizers produced at factories in South Africa and Australia, such as are used in large quantities for agricultural purposes in those countries, as well as a variety of chemical products, are also included.

There is a popular fallacy that the explosives industry is dependent upon war for its prosperity, whereas the manufacture of explosives for industrial purposes at a low price is one of the fundamental necessities of modern progress: factories for the production of industrial explosives form the nucleus for the manufacture of munitions of war in a national emergency, and this represents the true relation of the industry to war-like purposes.



The model in the Nobel bay has been made to illustrate the influence of Nobel Industries Limited. It consists of a piece of country on which are situated collieries, quarries, public works, etc., to illustrate the application of blasting explosives; the railway, the application of leather cloth, electric welding, incandescent mantles, non-ferrous metals; the tramways, Thermit welding; the motor cars, John Marston and excelsior radiators and Rotax Lighting; the bicycle shop, "Sunbeam" bicycles and motor bicycles; the boot shop, Necol products. Ammunition and propellent explosives are suggested by the fort. The tents have the lightning fastener. The lighthouse uses gas mantles and sound signals. The wreck suggests Tonite explosive. On the shooting estates, Eley and Kynoch shot-gun cartridges are used.

The importance of explosives in the development of industry will be appreciated from the fact that in winning coal and metal ores from the mines of the empire, 50,000 tons of explosives, with the requisite blasting accessories—detonators, safety fuse, etc. —manufactured by Nobel associated companies—are used annually.

Mining does not exhaust the industrial application of explosives; their destructive properties for constructive purposes have been adequately represented in engineering projects, such as cutting tunnels, building roads and railways and removing obstructions to navigation. These and similar uses are illustrated by typical examples in the form of a model landscape in the Nobel bay, which it is expected will convey to the minds of visitors a better idea of the Nobel organization than a mere review of their products could possibly accomplish.

Nobel products contribute in a larger measure than is generally appreciated to the sum of commodities necessary for modern conditions of life; semi-manufactured goods of non-ferrous metal, such as brass and copper rods, wire, hollow brass and copper ware, brass fittings of all sorts, collodion products, leather cloth and other commodities in the exhibit illustrate this point. Nobel's also own and operate a mint, and are, therefore, equipped to execute coinage contracts for overseas governments.

Visitors will observe the relationship between the metal and the explosives sections of this undertaking—especially in the apparently insignificant, but really important, detonator—and also in sporting cartridges for shot-guns, rifles, revolvers and containers of greater calibre or explosives charges.

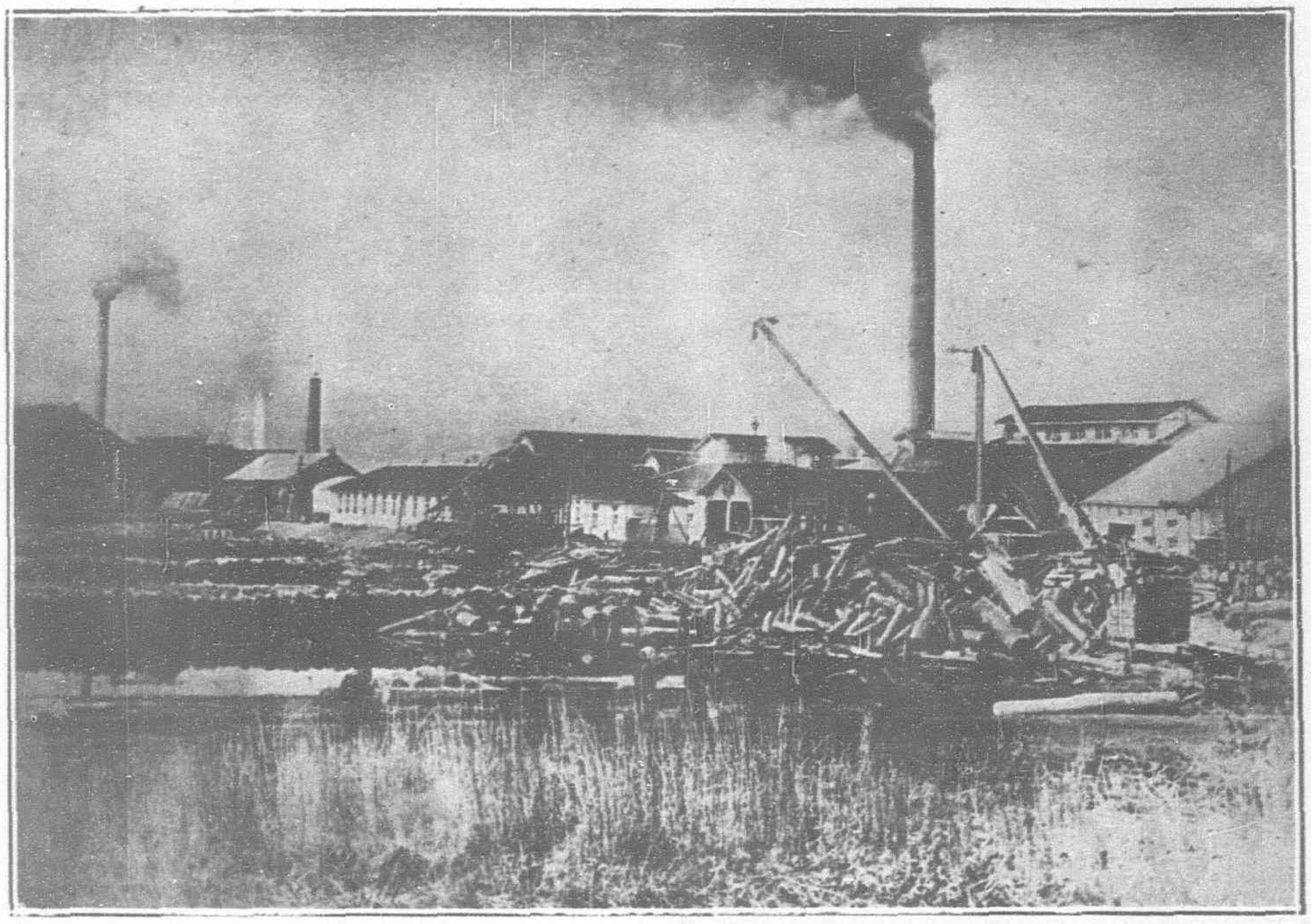
Analytical, research and metallurgical chemists, mechanical and chemical engineers and other specially trained experts collaborate continuously in the development of the manufacture of these highly technical products; thus constant attention to the improvement of the quality of existing products, and to the development of new commodities, has led to the name Nobel being recognized as the standard of quality throughout the world for the commodities with which it is identified.

The advent of the British empire exhibition has afforded an opportunity of presenting in concrete form particulars of the products of the associated companies of Nobel industries in one composite exhibit, and arrangements have been made to present visitors with a specially designed medal minted in the coining press in the Nobel bay in commemoration of this event.

The Veneer Industry of Japan

By Eisaburo Kusano

WHEN Rome was in at the height of its ancient prosperity, Roman furniture makers are recorded to have gone to Greece for beautiful and precious Oriental woods with which to manufacture inlaid tables and ceilings. But it was not until some 30 years ago, that the veneer manufacturing industry really began to show progress. The modern increase in the demand for high class furniture, and the steady decrease in the veneer trees usually of mountain growth have stimulated the veneer industry to remarkable development.



The Nitta Veneer Manufacturing Works, Hokkaido

Primarily, only rare varieties of trees were made into veneer. In recent years, however, ordinary trees such as maple, oak, and ash are also being used, mainly because of the cheapness of the trees and of their many characteristic advantages.

By the use of veneering machines thin boards of almost any size are easily obtainable. Such a board is almost entirely free from warping, cracking, shrinking, expanding or undergoing any change of form as a result of weather conditions. As several thin sheets can be glued together lengthwise and breadthwise, the flexibility of such an aggregate far exceeds that of thick one piece boards so that the veneer board is considerably lighter, as well as being stronger.

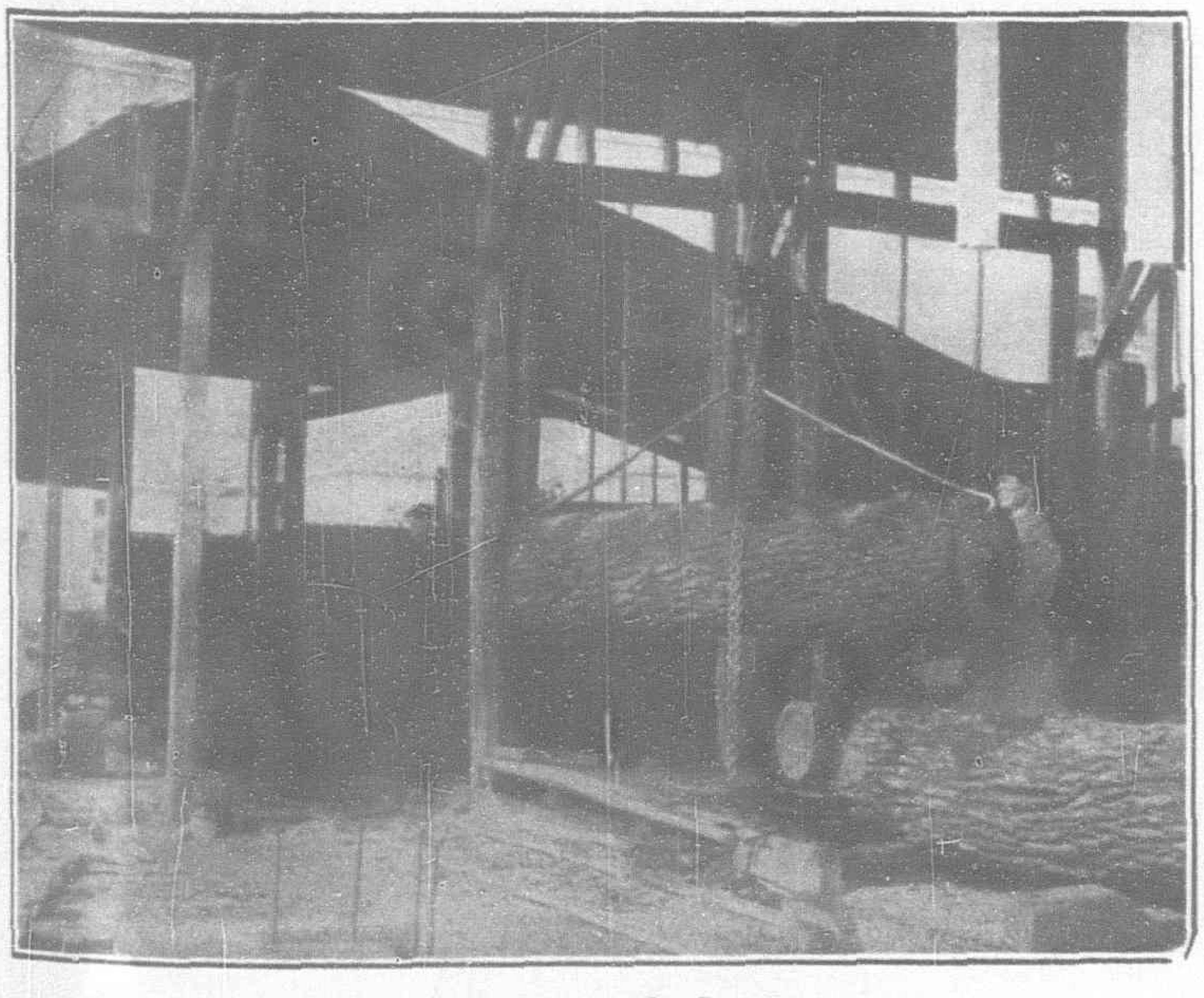
Veneer boards are now used widely in Japan, both in Japanese style construction and foreign houses. They are also used in large amount for manufacturing doors, tables and other furniture, tramcars, railway carriages, steamers, gramophones, toys, automobiles, and aeroplanes. For aeroplanes, birch and cottonwood veneer boards are mostly used, because of their light weight and resistance to change in weather conditions. Although the thickness of boards for this purpose varies in accordance with the part for which the board is used, it ranges from 1 m/m to 10 m/m, but in the main the 1.5 m/m and 3 m/m boards are the standards. The body, walls, ribs, and the beds of engines of Japanese military and naval aeroplanes are almost exclusively built up from veneer boards manufactured by the Nitta Veneer Manufacturing Works Partnership, Japan's greatest plant.

Generally speaking, there are three methods whereby veneer boards are manufactured. They are: Grain veneer boards made by a rotary lathe; quarter veneer boards by a slicing machine and boards by the so-called veneer sawing method.

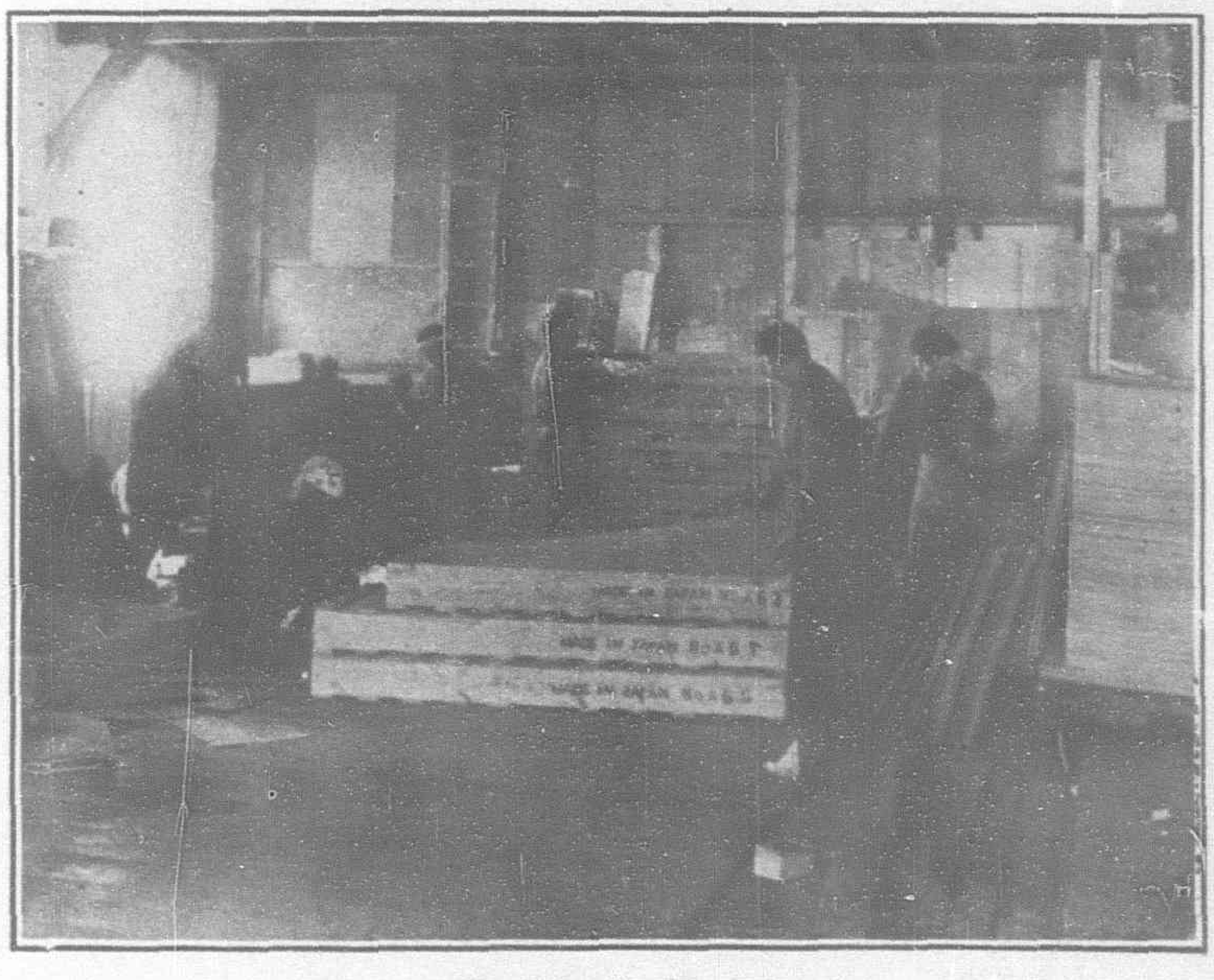
In rotary lathe cutting the log is dipped in hot water for a while in order to soften the wood. On being taken out of the hot water, the bark is removed, and both ends of the log are cut off by a drag-saw to the required length. The barked log, then, is held by the spindle of the rotary veneer lathe. As the spindle turns, the knife of the lathe, which is set tangent to the log peels the wood in a thin ribbon to the required thickness but it is as wide as the log. By this method, the thickness of the board may be fixed at any point between a gossamer web and ⅜ inches.

This method of slicing is especially used in handling such trees as cryptomeria, paulownia, and mahogany. These trees have beautiful grain effects which are brought out in the quarter-sawed wood. By using a band-saw these woods may be sliced to any thickness between 1/150 inch and ¼ inch.

In veneer-sawing a fine quarter-sawing band-saw is used and

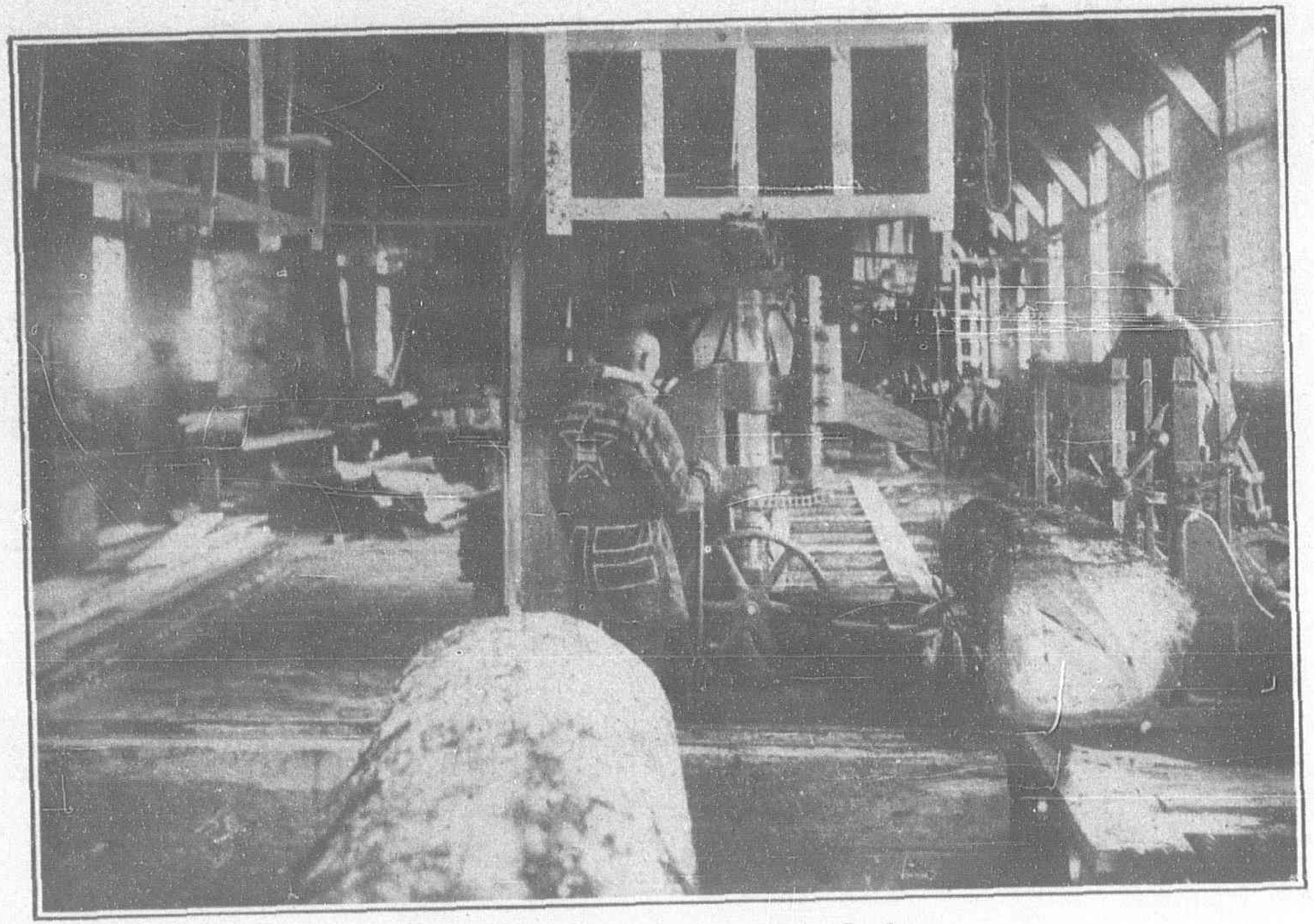


Squaring up the Log

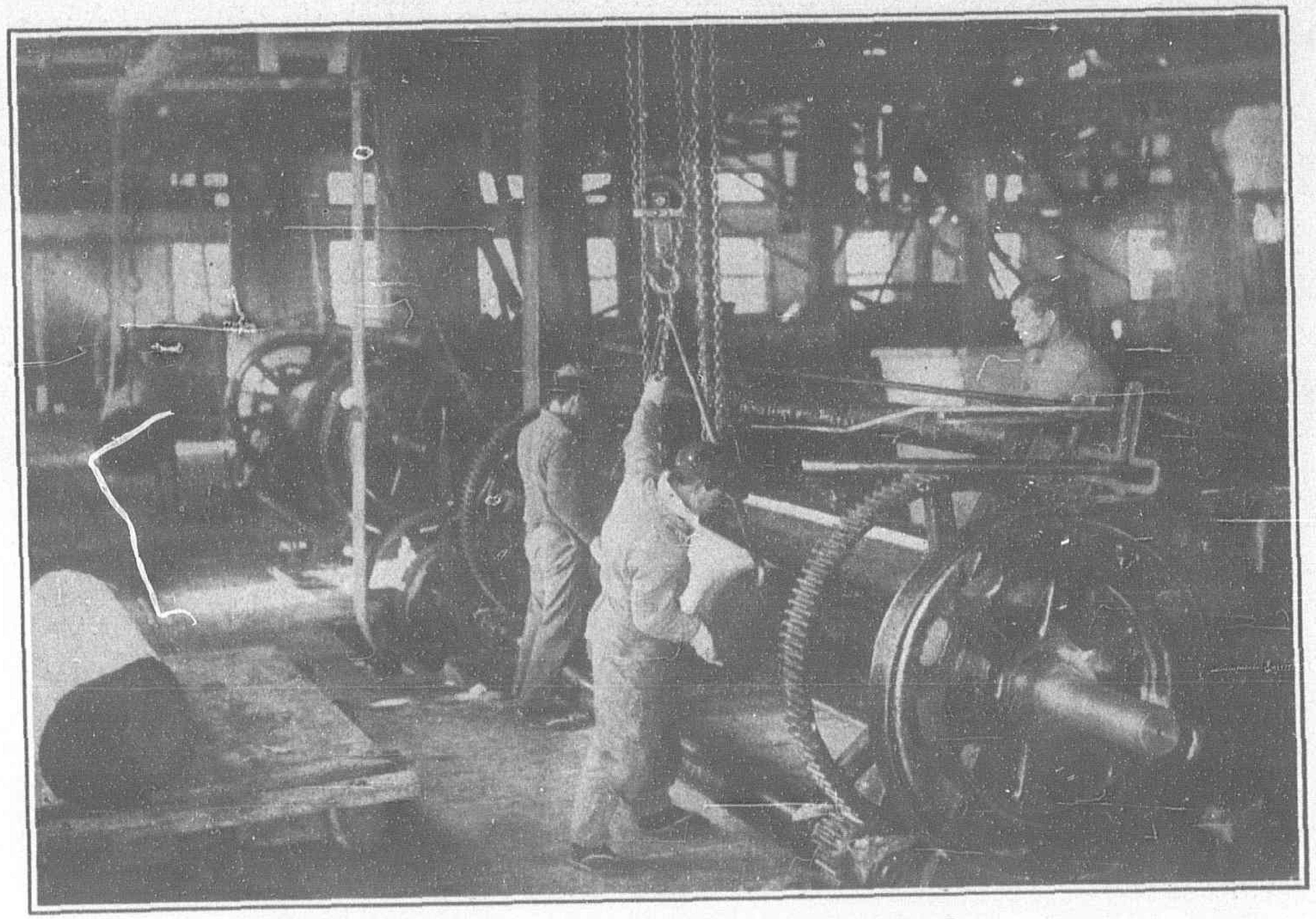


Packing for Export

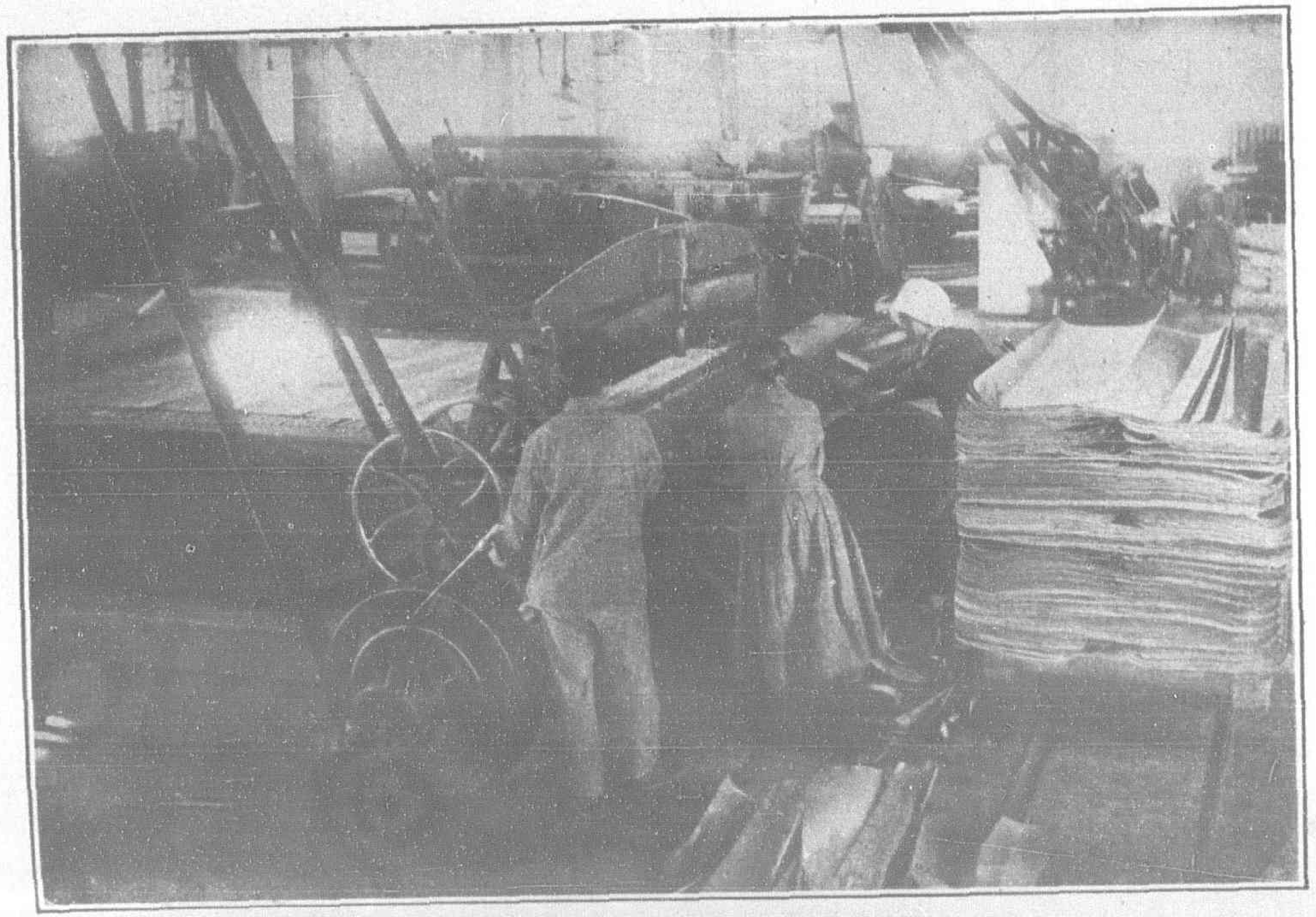
EQUIPMENT OF THE NITTA VENEER WORKS IN HOKKAIDO



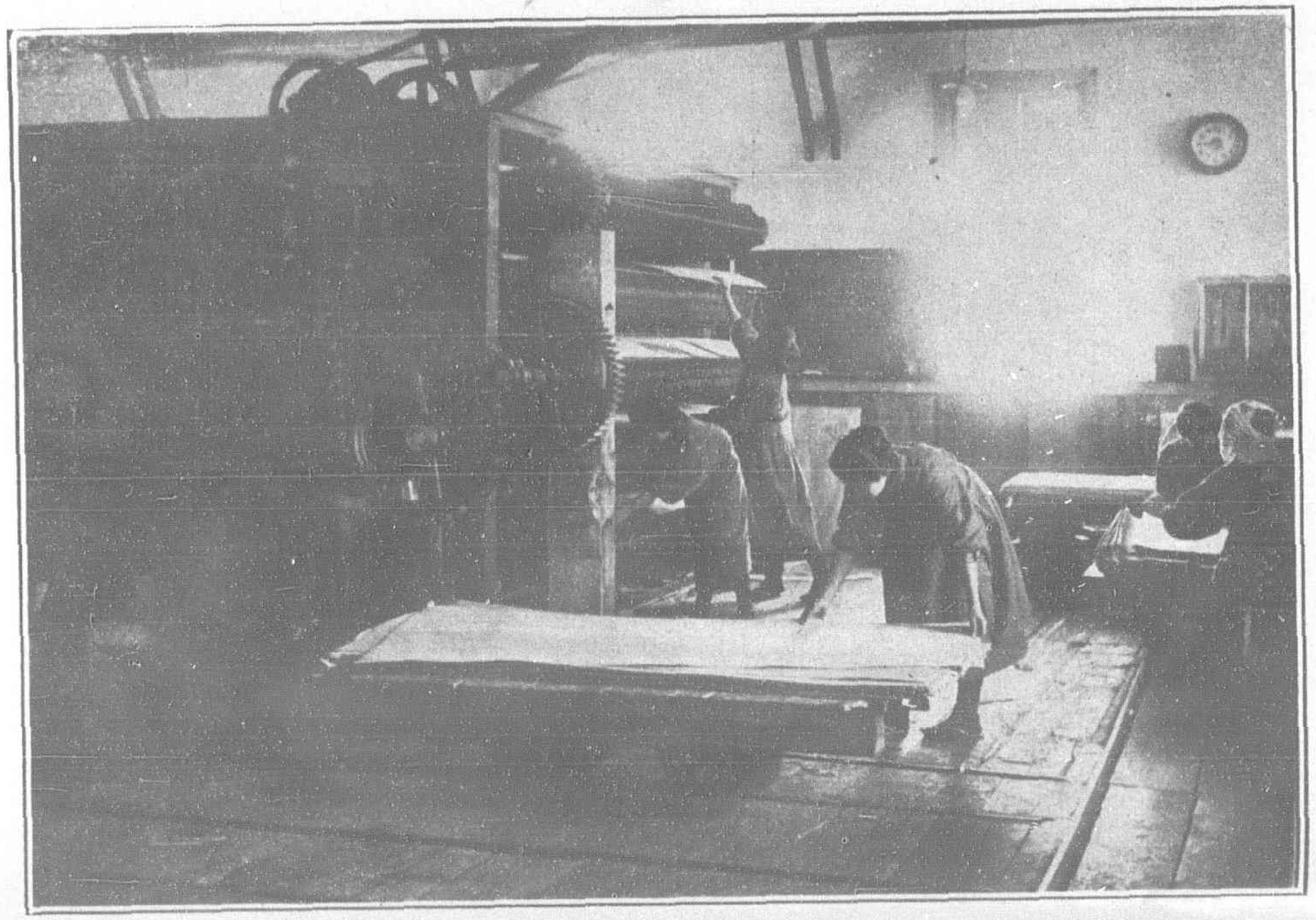
Band Saw to Prepare Logs for Lathe



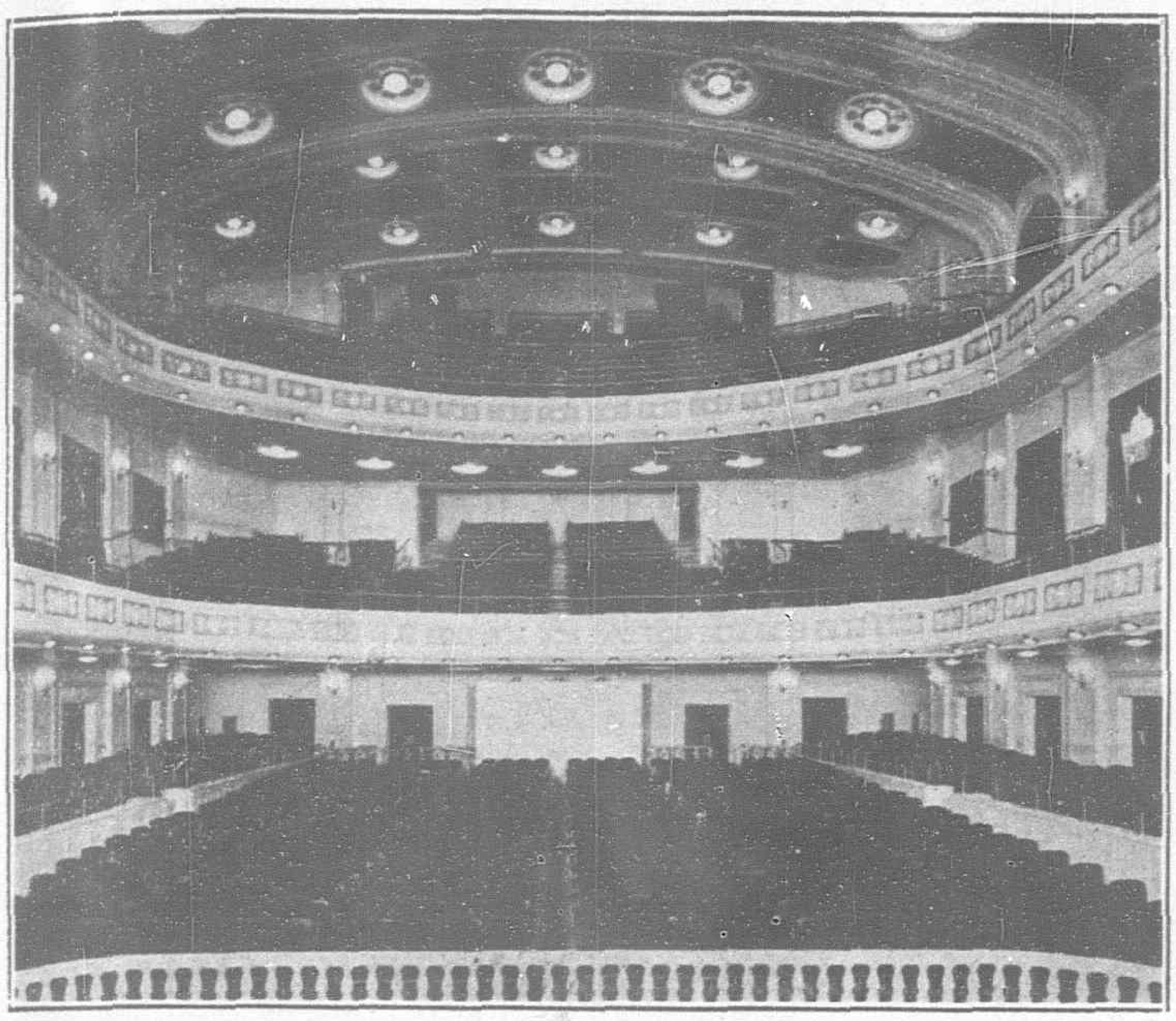
Rotary Lathe Slicing Veneer Sheet from the Log

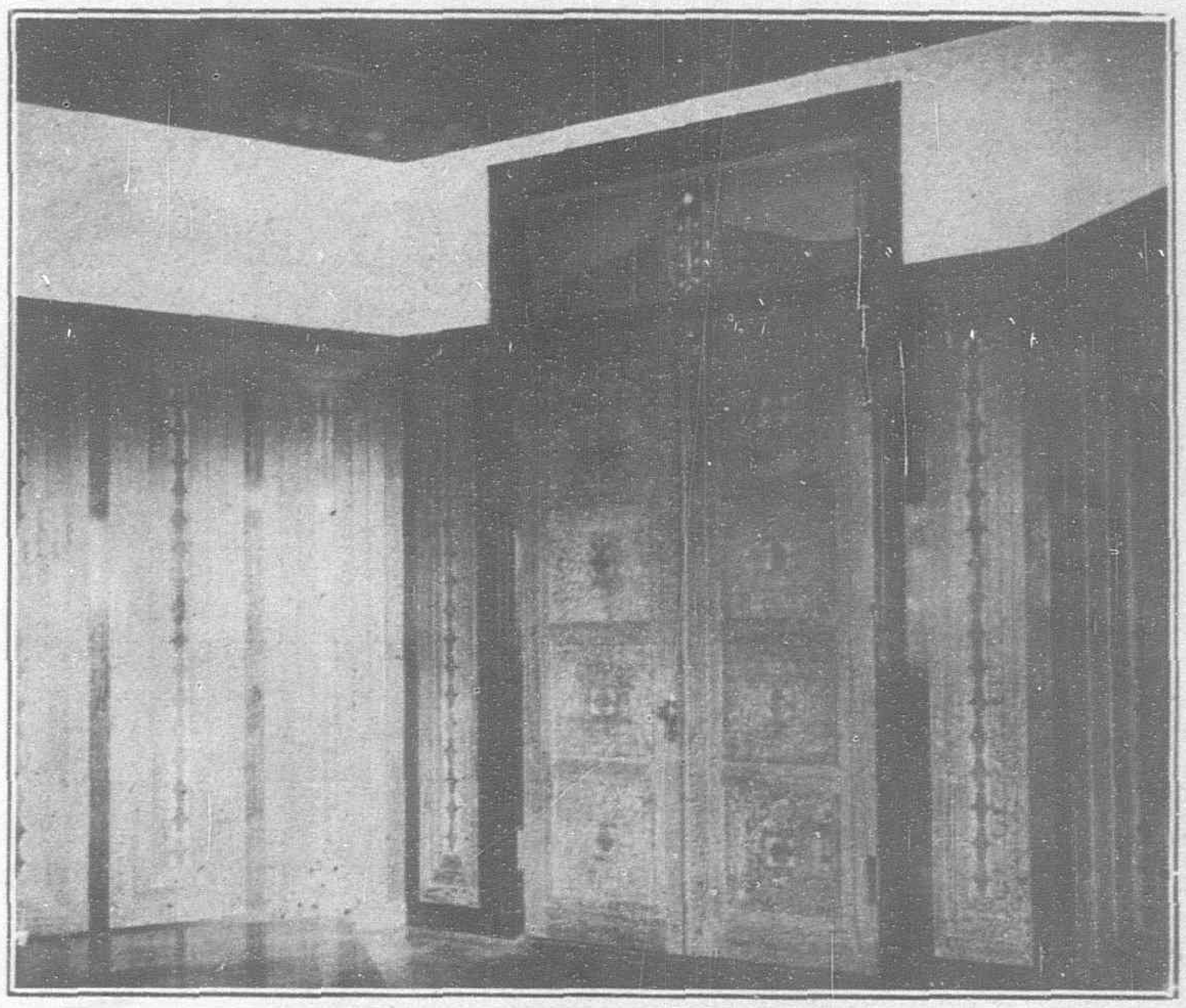


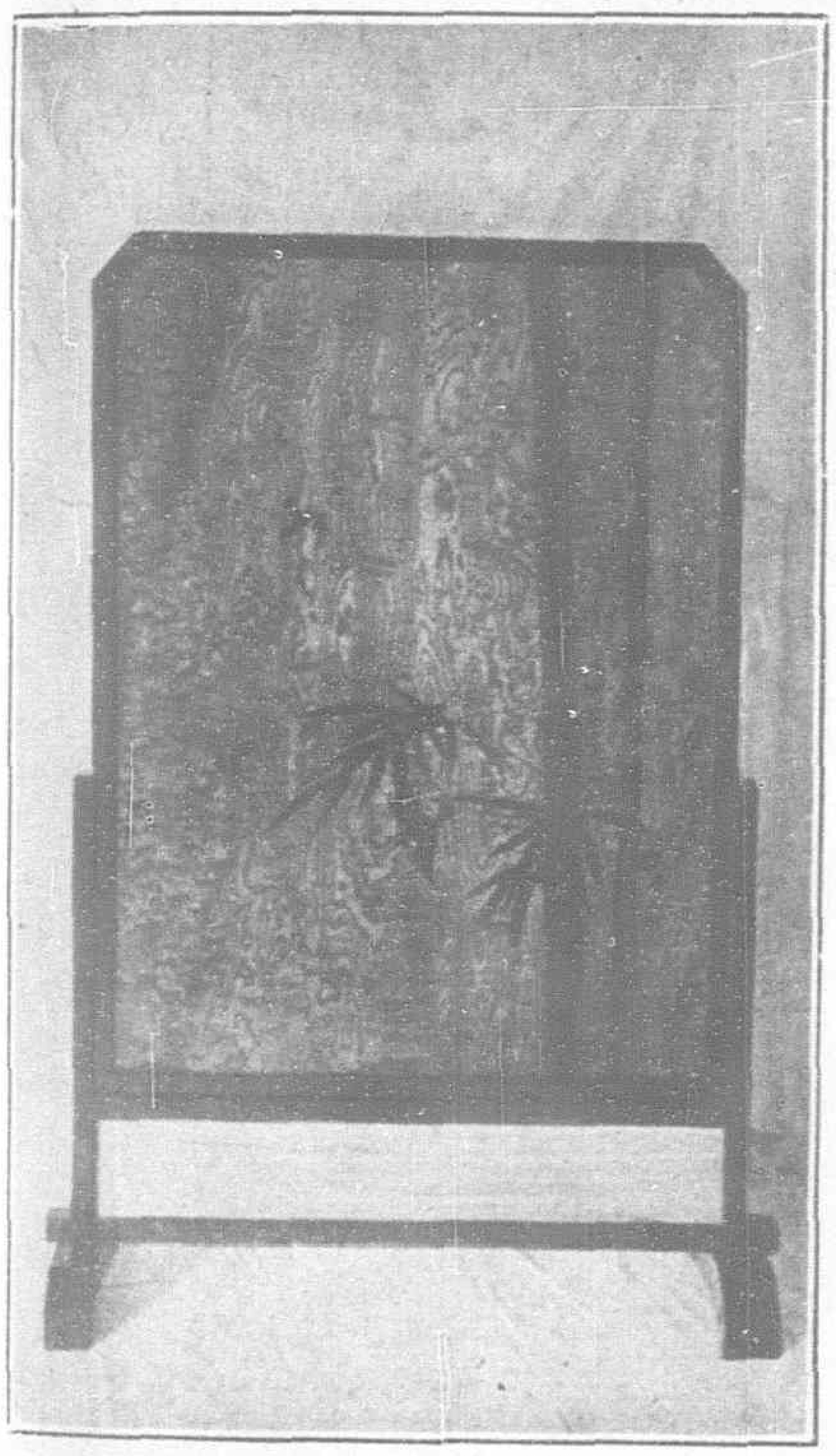
Cutting Veneer Sheets into Standard Sizes



Drying Machine for Veneer Sheets



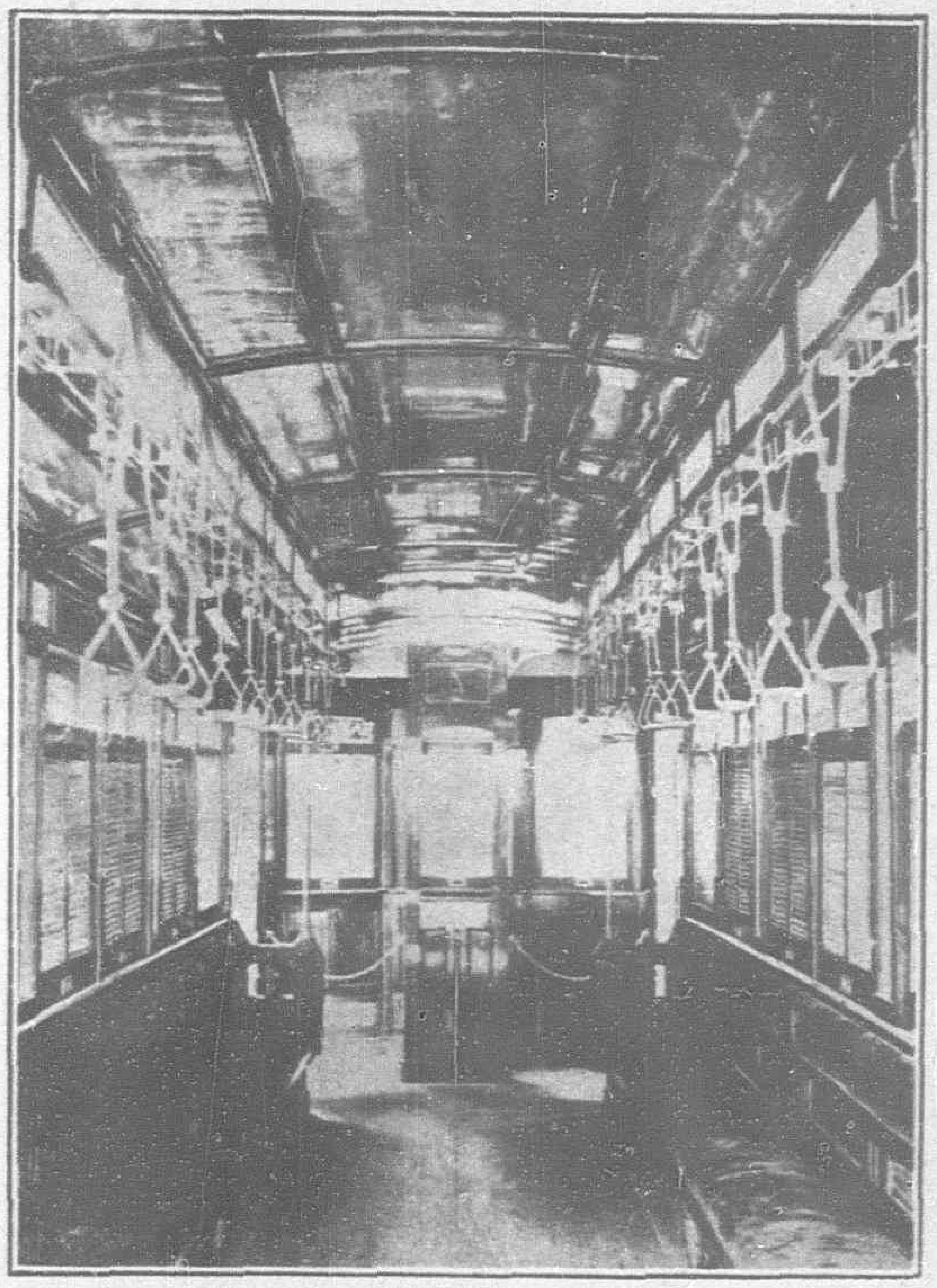


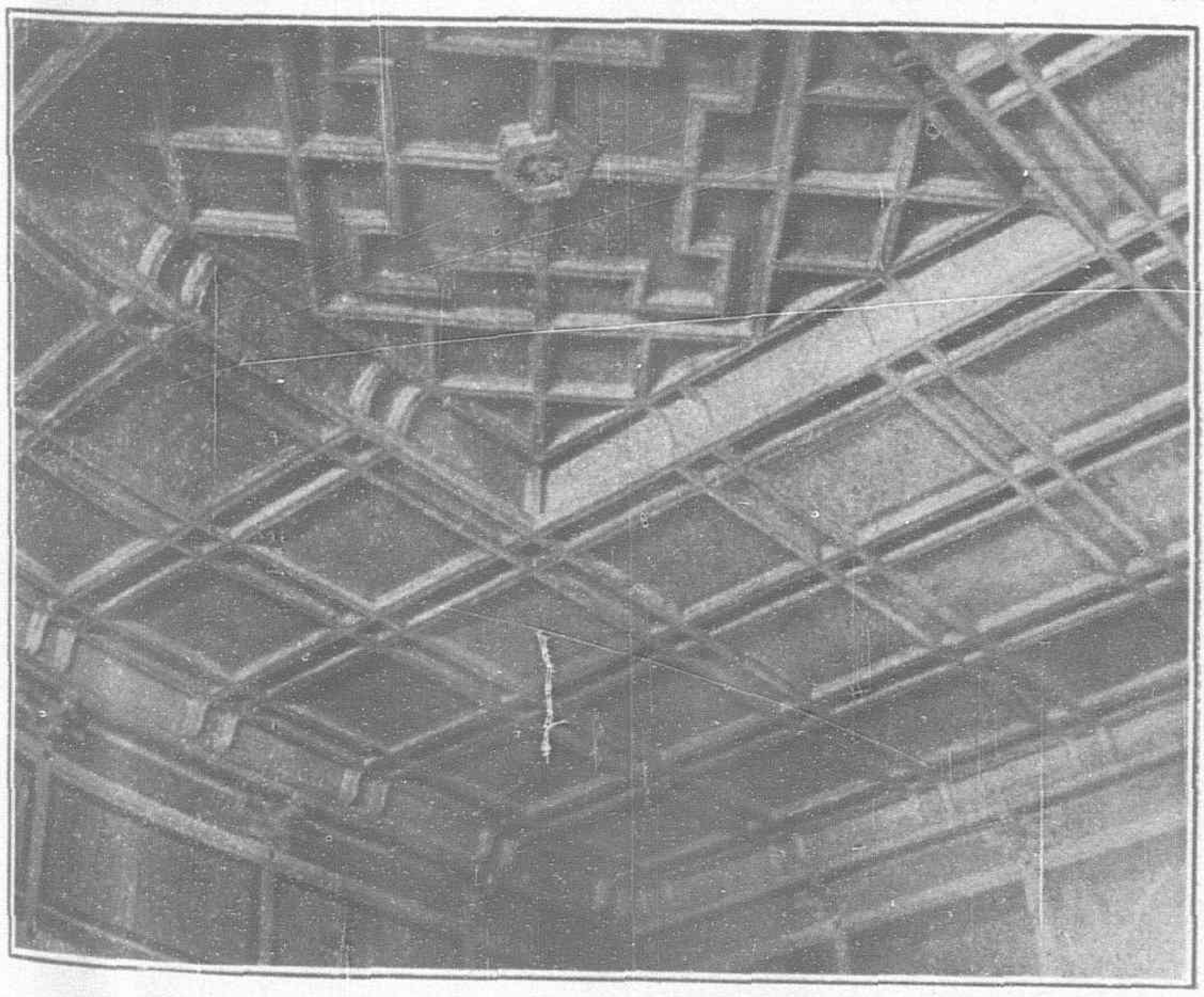


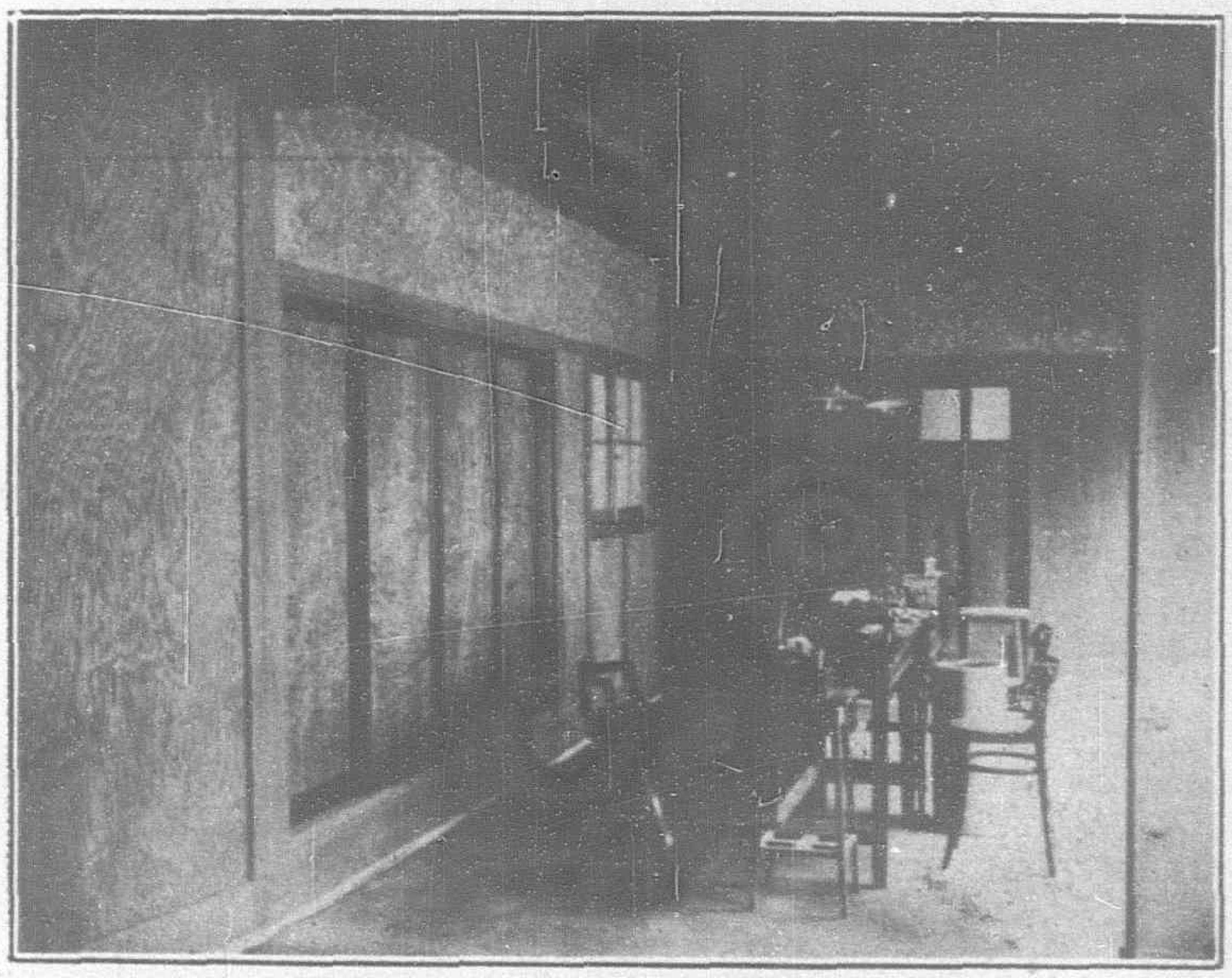
boards of $\frac{1}{28}$ inch to $\frac{1}{16}$ inch thick are produced. This method is mainly applied in manufacturing quarter-sawed oak veneer. Compared with slicing, it results in 30 to 60 per cent., greater loss of wood.

Thin boards thus manufactured contain a large quantity of moisture, and consequently, must be dried before they are fit for veneer. In drying these thin boards, several methods are now in use, but is now generally recognized that the dry kiln process is the best. Great importance is attached to drying, because the advantages characteristic of a veneer board, depend largely upon how well each thin board is dried. ■

Three, five, or seven sheets of the dried thin boards, which are to be veneered together, are cut to size by a joinder-saw. In making a three-sheet veneer board, the central board goes through a glue spreader roll, whereby both sides of the board are coated, and, then, the two outside boards are placed lengthwise on both sides of the breadthwise glued board. In making five or seven sheet veneer boards, two or four sheets







Examples of Uses of the Products of the Nitta Veneer Works.

Shochiku-za Theatre at Osaka.
Chairs and Interior Woodwork of Oak Veneer.
Ornamental Veneered Ceiling.

Door and Panel of Oak Veneer.
Tramcar in Osaka Finished in Maple Veneer.
Japanese Office Finished in Veneer.

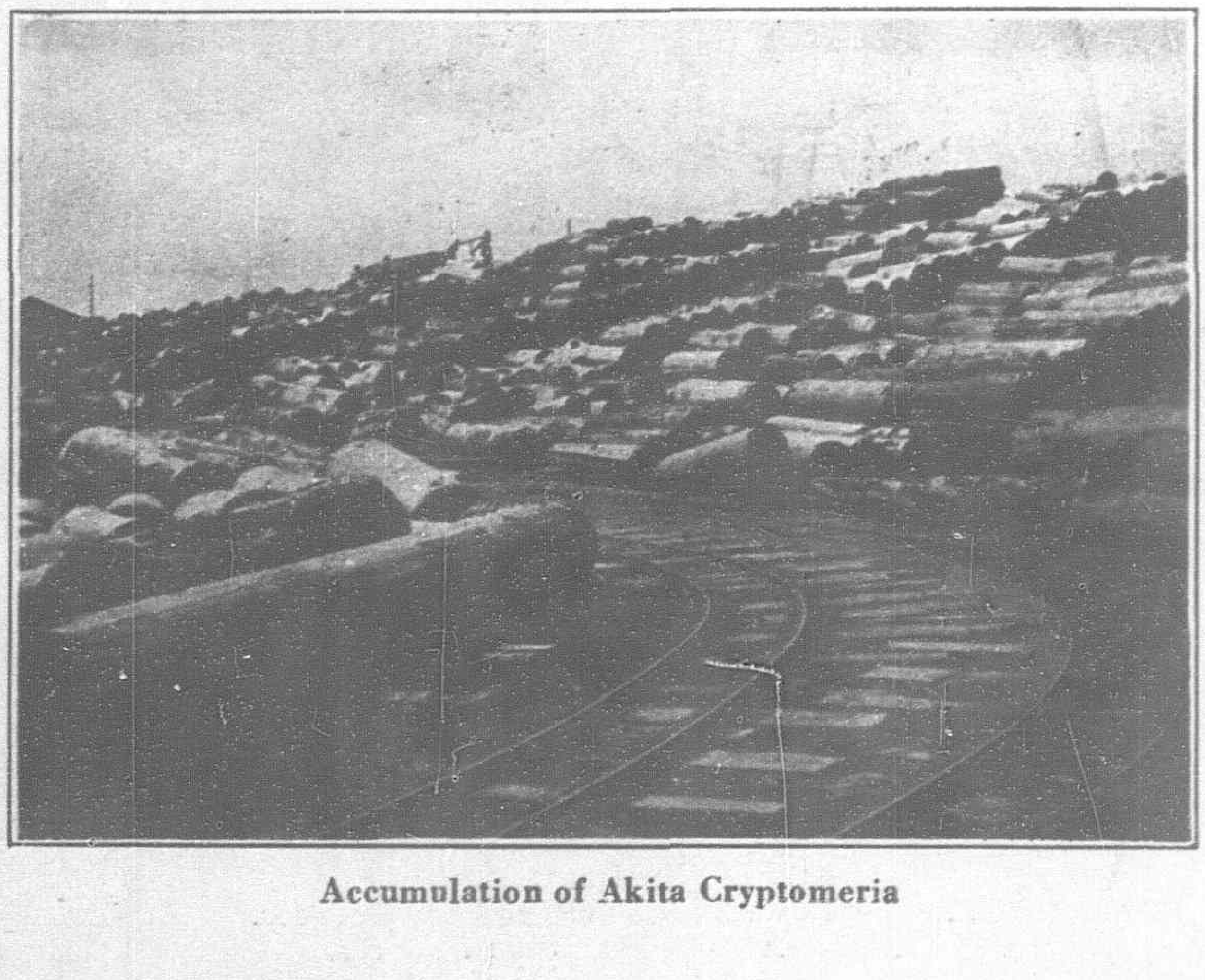
Mill of the Akita Lumber Co. (Akita Mokuzai Kabushi)

are glued above and below the three-sheet veneer board. The glued boards are then put under a hydraulic press of over 100 pounds per square inch. Then a clamp is fixed on the edges while the boards are under pressure. On removing the pressure, the veneered boards are left for more than 24 hours in the clamp. After the clamp is removed, the veneered boards again are dried. With the double cut-off saw and lip-saw, the ends of the dried veneered boards again are trimmed, and then finished with the scraper machine. The veneer boards are then ready to be varnished or painted.

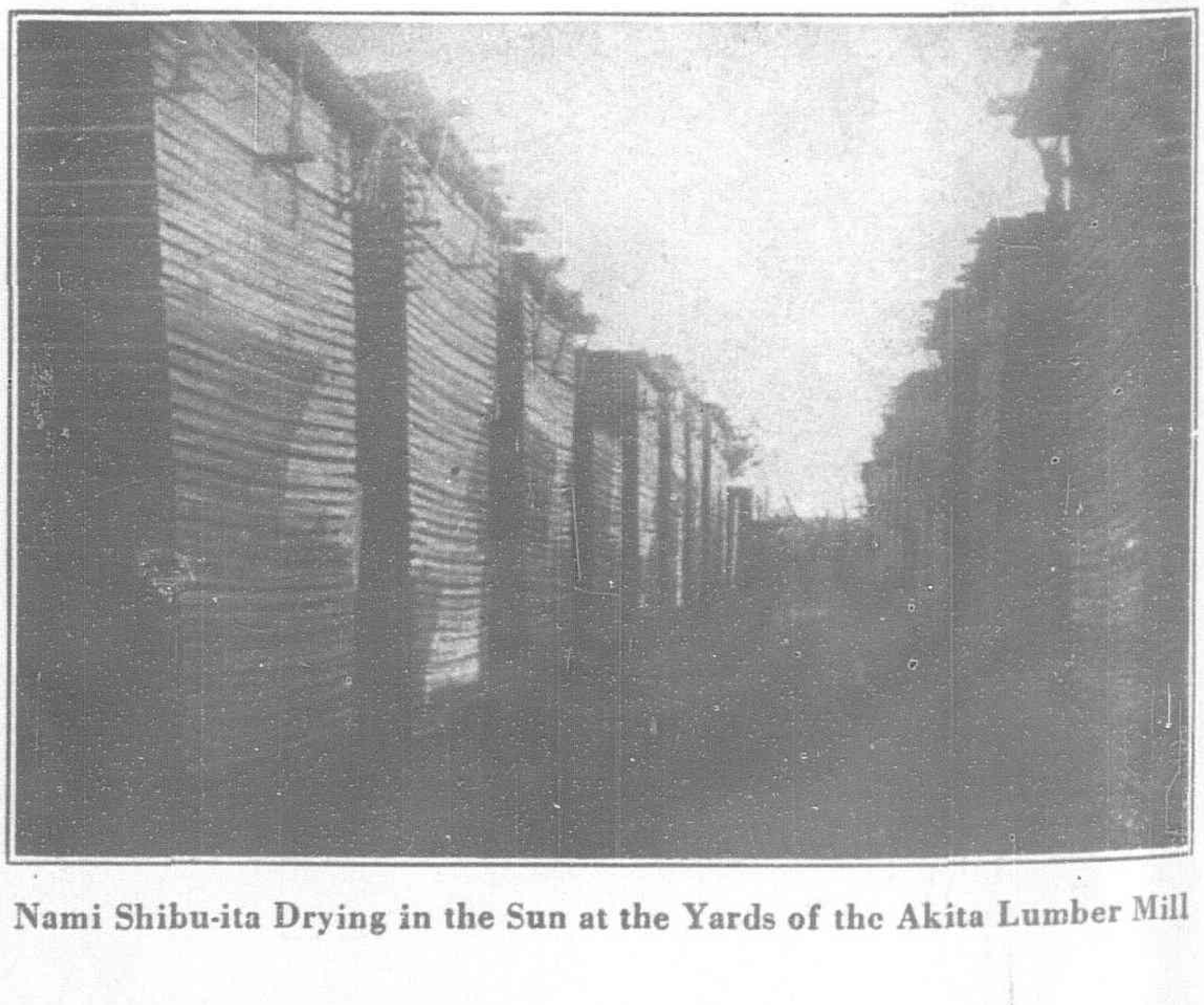
The veneer manufacturing industry was introduced into Japan by the department of agriculture and commerce in 1909. The forestry bureau of the department installed the first veneer machinery in the official saw mill at Kajiya, Miyagi Prefecture. Ten years later, on July 5, 1919, Goshi Kaisha Nitta Veneer Seizosho (The Nitta Veneer Manufacturing Works Partnership) was organized with a capital of Y.500,000, with Mr. Chojiro Nitta as the representative partner, and his son, Mr. Aisuke Nitta, as the chief of the factory, which was built at Yamuwakka, Nakagawa-gun, Tokachi Province, Hokkaido.

The Nitta veneer manufacturing partnership produces approximately 20,000,000 square feet of veneer boards annually and exports to Australia, New Zealand, the United States, Canada, and Europe, in addition to Oriental countries, especially to Shanghai and Manchuria. It has no rivals of importance in Japan. The Hokkaido factory of this company, the buildings of which cover an acre, is equipped with the following machinery, mostly manufactured by the Coe Veneer Machinery Manufacturing Company, of the United States. One 100 inch veneer lathe, one 50 inch veneer lathe, one proctor dryer, annual capacity, 20,000,000 square feet, three hydraulic presses, one sanding machine, one scraper, one slicer, and many other small machines including saws of various kinds.

The Nitta veneer manufacturing partnership is now building a new factory of reinforced concrete in the neighbourhood of the present factory. It will have a veneer door manufacturing factory, necessitated by the recent remarkable increase in the demand for this article. A 120-in. veneer lathe, which was ordered together with many other machines while Mr. Aisuke Nitta was in

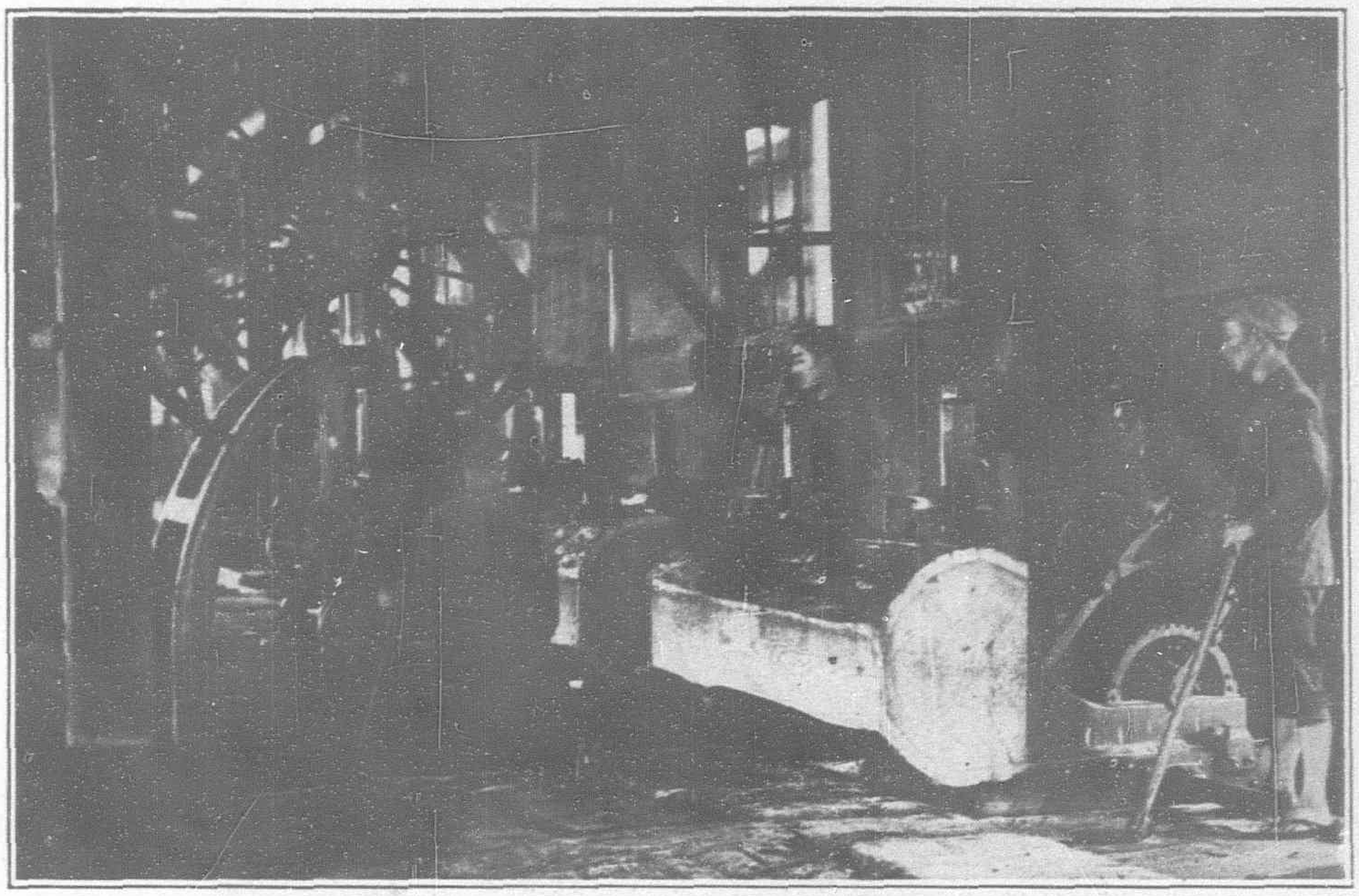


Accumulation of Akita Cryptomeria

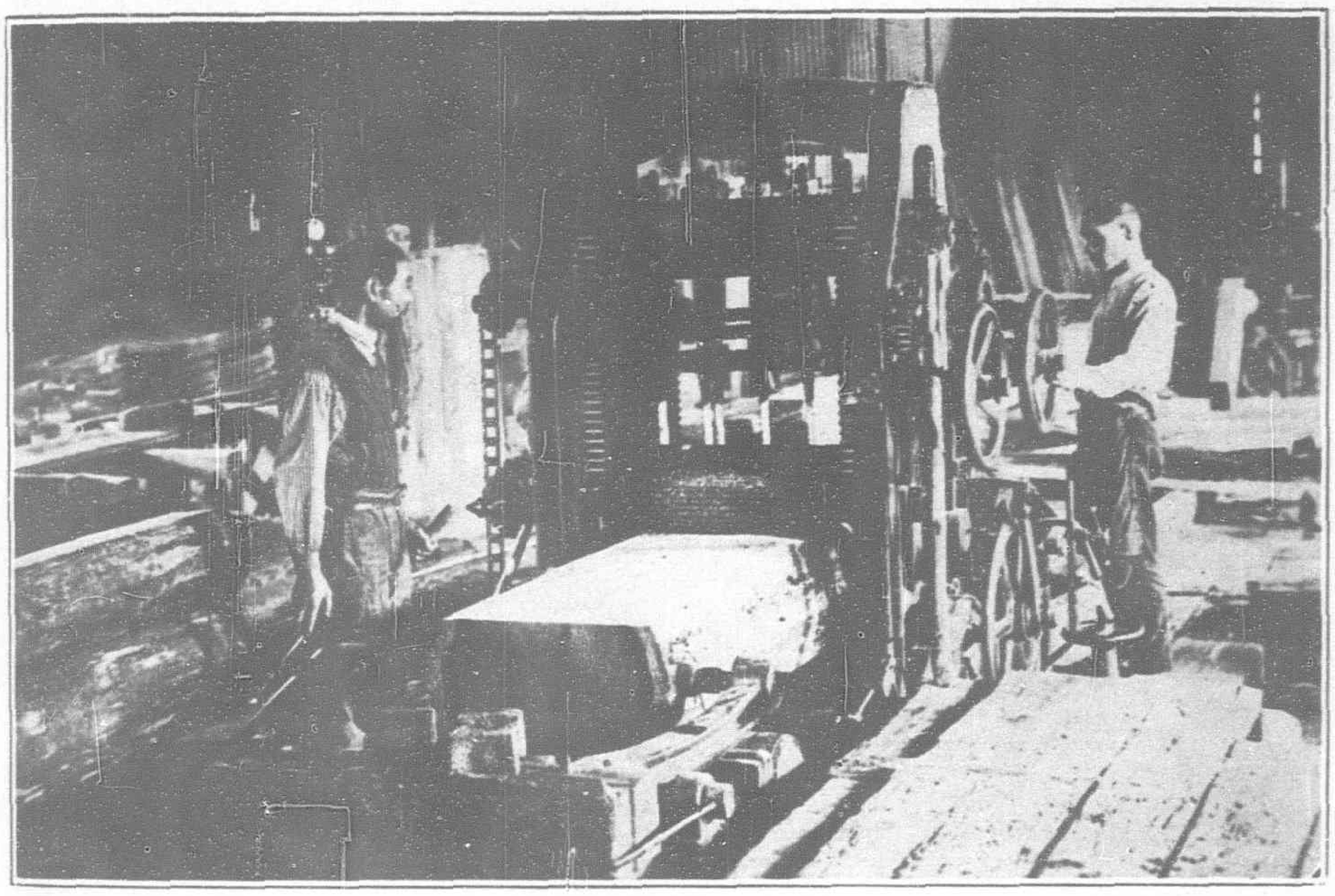


Nami Shibu-ita Drying in the Sun at the Yards of the Akita Lumber Mill the United States last year, has recently arrived at the Hokkaido factory. This machinery will be set up in the new plant. At the Hokkaido factory, cherry, maple, cottonwood, birch, cryptomeria, ash, and many other trees are made into veneer boards, but the oak veneer is said to be enjoying the largest demand. The standard size of veneer boards made by the Nitta factory is eight feet by four feet. The sizes which are in greatest demand are: 3-ft. by 6-ft.; $2\frac{1}{2}$-in. by 6-ft. and 2-ft. by 6-ft.; but the factory holds a record of having made a veneer board five feet long by 30 feet wide for the Japanese Board of Naval Aviation. The standard thickness is $\frac{3}{16}$ or to $\frac{1}{4}$ inch.

The Nitta veneer manufacturing partnership has been appointed the official factory for the Japanese navy. Among its customers are the Imperial Japanese government railways, the municipal electric bureaus of Tokyo, Osaka, Kyoto, Nagoya, Kobe and several other cities, the arsenals, the military board of aviation, the naval bases at Sasebo, Kure, Yokosuka, and Maizuru dockyards; the Kawasaki, Fuji-Nagata and Mitsubishi iron works, also the Tanaka iron works, Osaka, the Umebaci and the Japan Rolling Stock Manufacturing Companies, the Shimizu and the Obayashigumi building companies and the Mitsui Bussan Kaisha. The head office is at Kuboyoshi-cho, Namba, Minami-ku, Osaka while branch offices are now established at Tokyo, Nagoya, Fukuoka, and Otaru.



Band Saw at the Akita Lumber Mill



Gang Saw at the Akita Lumber Mill

The New China Guide-book

THE new edition of the Japanese government railways' guide-book to China fully lives up to the high reputation gained by the first edition which was acclaimed by travelers as being the only dependable guide to all of China and the one which really covered the field instead of galloping hither and yon, hitting only the high spots. In its endeavor to present all of China adequately, the new edition even goes so far as to include Chengtu and Mt. Omi, places which most travelers never will see but which some of them might be induced to visit. The first 124 pages of the guide are a comprehensive though necessarily condensed resume of China as a whole, covering communications, population, political system, history, religion and art, in fact, this section of the book is an epitome of things Chinese and may be commended to those who have lived all their lives in China as well as to the casual tourist.

The arrangement of the various trips is from the East, Mukden being the first city described, the cities along the Peking-Mukden line being mentioned in detail to Tientsin. Peking is given exceptionally ample treatment side trips to Kalgan and other points of interest being described. The map of Peking city and another showing the environs that can be reached by motor are a feature that should assist the traveller mightily. The two railway routes from Peking to the Yangtsze are fully treated, every station of importance on both the Peking-Hankow and the Tientsin-Pukow lines is given mention. The Yangtsze Gorges are described in detail and even the Wuchang-Changsha railway is given space as are the various summer resorts in the Yangtsze valley. Returning to Nanking the traveller is given descriptions of the many points of interest on the railway to Shanghai, including Soochow, Changchow, the Taihu and even Huchow although it is off the beaten track. And so it goes—from North to South and East to West, this guide-book shows in every direction the same painstaking care to acquaint the tourist with every possibility of sightseeing. One of the most meritorious features is the array of maps of the various cities, specially prepared ones at that, which outline the points of interest in unmistakeable and ready reference fashion. The Japanese government railways are to be congratulated on this new edition of the only standard guide-book to China.

Simons & Co. Get Steamer Contract

Messrs. Wm. Simons & Co., Ltd., Renfrew, have received an order from The High Commissioner for India for a Twin Screw Cable Steamer for the Indian Government Telegraph Service. The vessel will be built under the direction of Messrs. Sir J. H. Biles & Co., Naval Architects & Consulting Engineers, London & Glasgow.

Armstrong Whitworth Secure Locomotive Contract

It is announced that Sir J. G. Armstrong Whitworth & Co., Ltd., have secured an order for 37 heavy main line locomotives for the Bengal Nagpur Railway. These Locomotives which are intended for goods traffic are of the 2-8-0 superheated type, with 6-wheeled tenders for a gauge of 5-ft. 6-in., and will weigh in working order about 113 tons. The contract has been secured in the face of very keen foreign competition. The engines will be built at the firm's Scotswood Works at Newcastle-on-Tyne, and it is anticipated that some of them will be shipped in running order in accordance with the firm's usual practice.

Shanghai Municipal Electricity Plant

Increase in Kilowatts is True Barometer of City's Industrial Growth

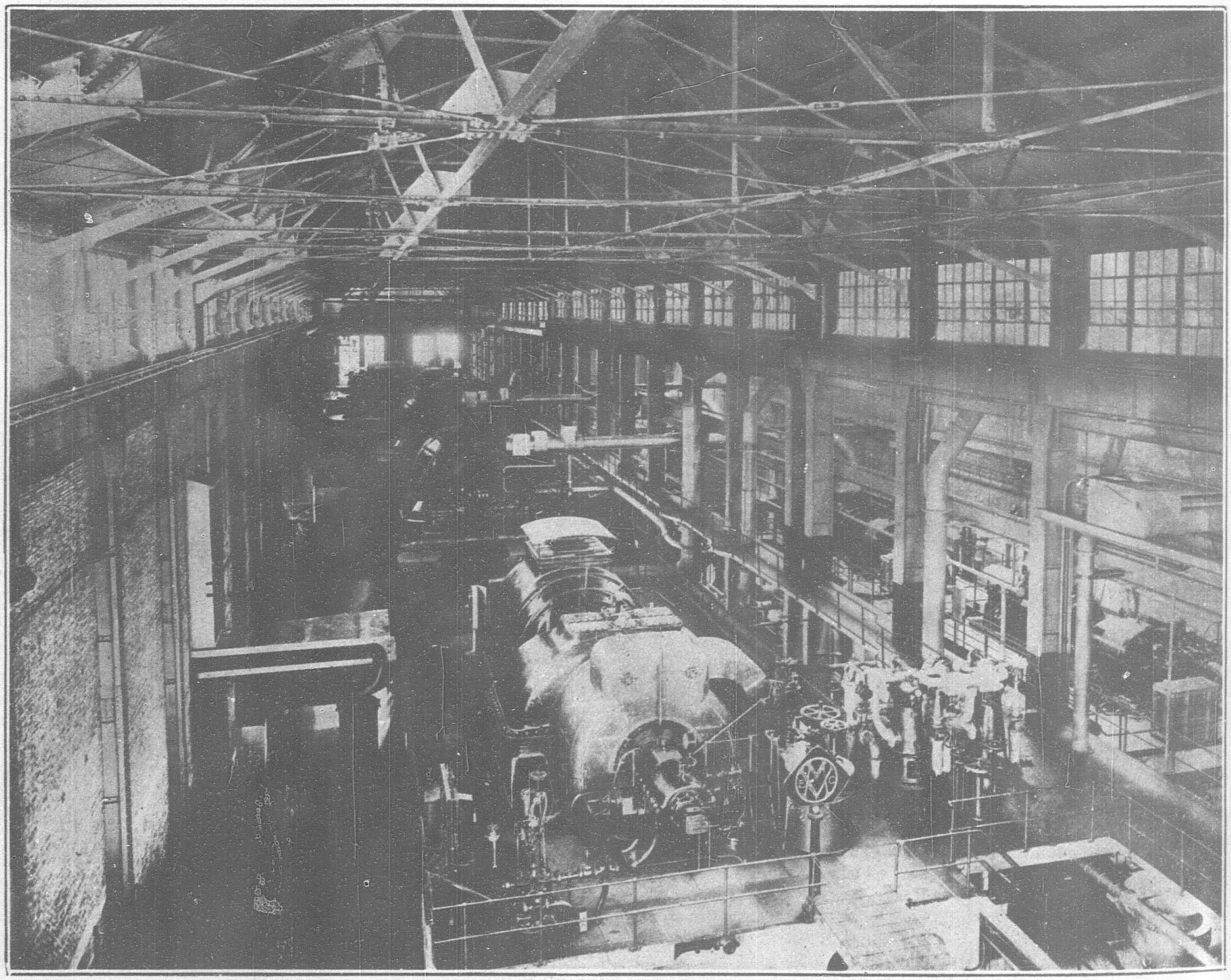
TO one who seeks a true index of Shanghai's industrial growth the report of the municipal electricity department must be illuminating. Likewise to those managers of electrical enterprises in various cities of Britain and America, it is possible that a feeling of envy or at least emulation arises when they scan the figures and curves which go to show that Shanghai is not only one of the best electrified cities in the world, but that it sells a larger percentage of its power than most any other. As an index of industrial progress in the last ten years, nothing can be clearer than the report of the electricity department which shows that in 1913 less than 6,000 horse-power in motors were carried, while in 1923, this item had risen to 101,331 horse-power. That comparison ought to be sufficient tribute to those who have guided the destiny of the department. In that connection, *The Engineer*, Britain's greatest engineering journal, says :

> The annual reports of the Shanghai municipal electricity department have been for years of a nature to arouse admiration, if not envy, in the minds of station engineers in this country, and to cause ordinary people to wonder when we shall be able to record a corresponding progress in any of our own areas of supply. Shanghai uses coal for generating purposes, as we do, and although it has a large cotton-mill load it cannot have advantages in this respect over certain parts of Lancashire. If Shanghai had no electricity supply at all, or at best a little antiquated plant, one could find many reasons why matters should be thus ; but when we find a town in "the unchanging East" easily surpassing any municipal undertaking in this country in output of electricity, we have little cause for self-congratulation. The following figures, taken from Mr. T. H. U. Aldridge's annual report for 1923 on the Shanghai undertaking of which he is the manager and engineer-in-chief speak for themselves :—

Year ending	Undertaking.	Units Sold for year.	Load Factor per cent.
1923...	... Shanghai ...	... 272,265,861	49.42
,, ...	... Manchester...	... 185,638,834	29.41
,, ...	... Glasgow ...	... 141,919,196	27.95
,, ...	... Birmingham	... 139,468,153	25.26
,, ...	... Sheffield ...	... 123,438,177	26.96

Financial

According to the annual report of the Engineer-in-Chief and Manager, Mr. T. H. U. Aldridge, notwithstanding the continued trade depression, the sales of electricity in 1923 for various purposes increased from 232,457,361 to 272,265,861 kilowatt-hours, or 17.12 per cent. The result of the year's trading shows a net profit of



RIVERSIDE POWER STATION OF THE SHANGHAI MUNICIPAL ELECTRICITY DEPARTMENT

View of Turbine House Looking South. New 20,000 K.W. Turbo-Alternator and Air Ejectors in Foreground, and two 3,000 K.W. Turbo-Alternators for House Service Supply in Adjoining Bay

Tls. 1,514,884. Whilst the sales of electricity for light, heat and traction come closely to the estimated figures, the sales for power purposes are short by 18,278,115. In the report for 1922 reference was made to the inactivity of most of the flour mills supplied with electric power. During 1923 this industry was more active, and most of the mills were working at intervals. Against this recovery has to be set the falling off of demand in the cotton spinning industry. Although few of the mills actually ceased to run, some of them went on half time, consequently the sales of electricity were lessened proportionately. Mills in which new spinning plant had been added did not put this new machinery into service. Considering the depressed condition of the cotton industry the fact that there has been an actual increase in sales of power may be regarded with satisfaction.

The financial standing of the undertaking at December 31, 1923, is :—

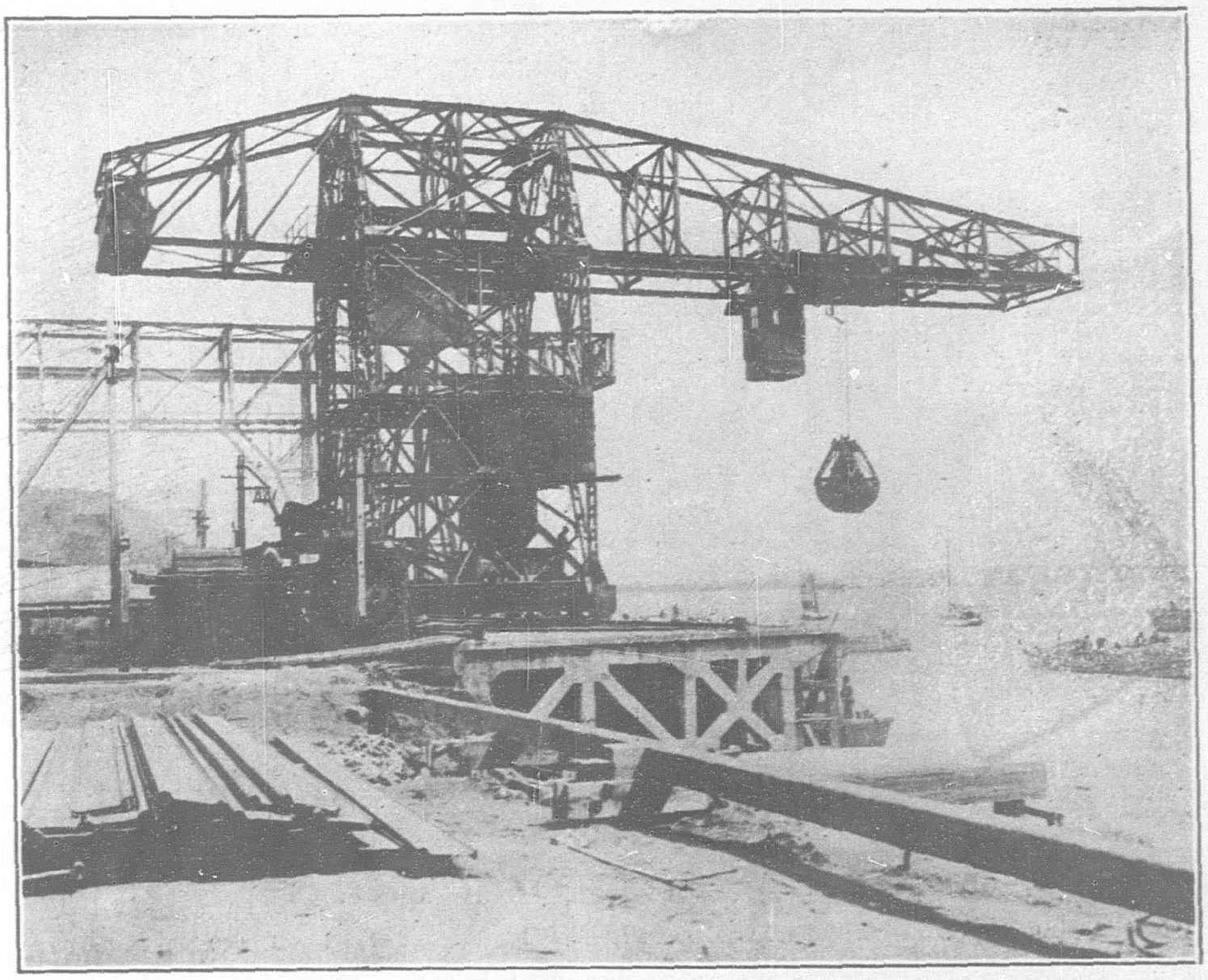
Capital outlay of the undertaking	Tls. 29,599,162
" " on plant actually in use	" 27,308,196
Return on capital outlay actually in use	10.39%
Revenue from sales of electricity, rent of motors, etc. ..	" 8,572,449
Gross profit (after allowing for depreciation)	" 2,836,960
Nett profit after provision for interest on loans and other nett revenue expenditure ..	Tls. 1,514,884

(The estimated net profit was Tls. 1,398,951).

Since 1916, Tls. 3,760,000 of electricity profits has been handed over to the council as contribution to general municipal funds, for application to other municipal purposes. The estimated net profit for the year 1924 is Tls. 1,354,800.

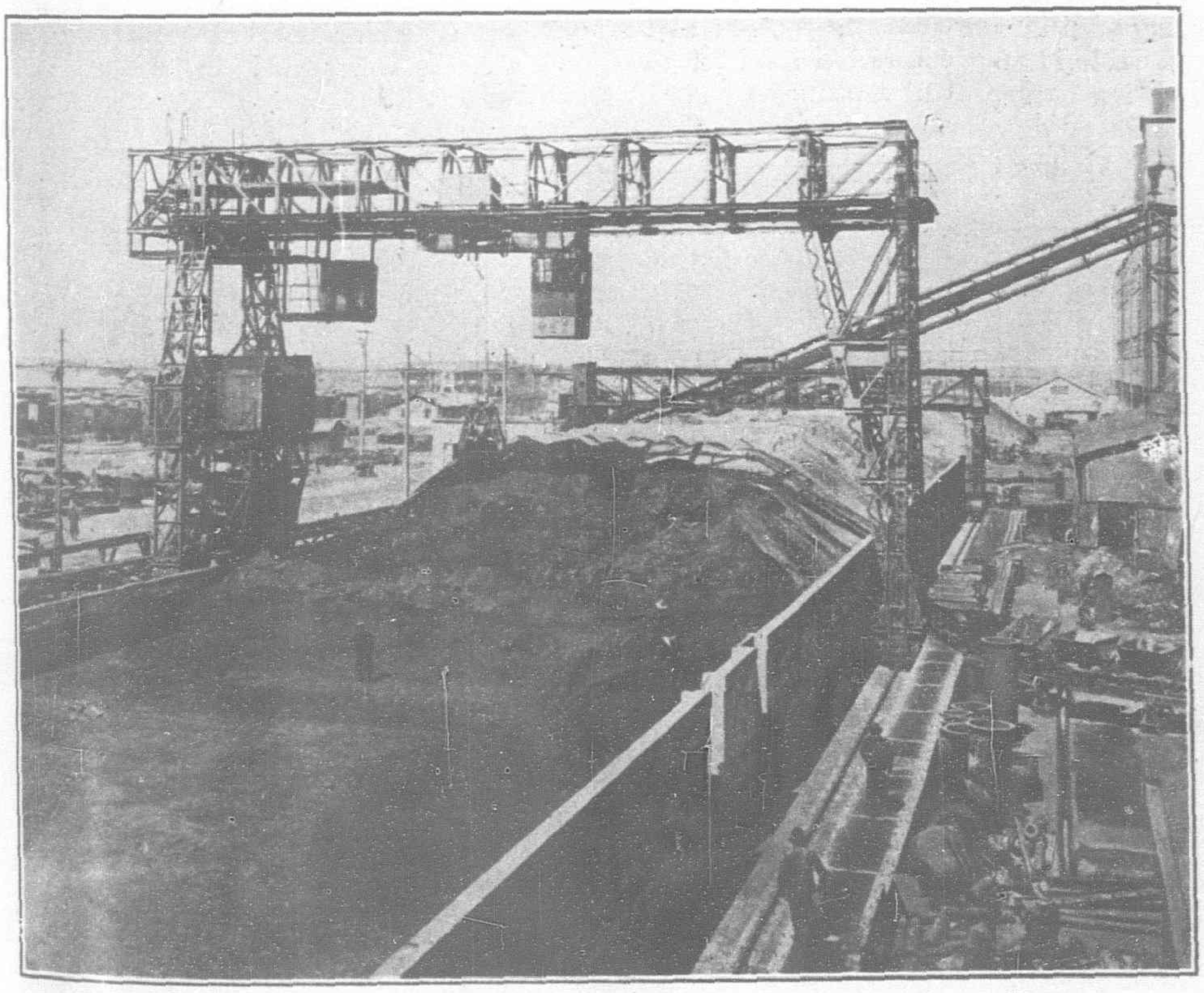
With the exception of a few minor details, the extensions of the riverside power station, sanctioned in 1920, were completed. The installed plant capacity of the station is now 121,000 kilowatts. (This includes the 20,00 k.w. turbine which was destroyed in November last, and is being replaced). The plant comprises the following :—

Two 2,000 k.w. turbo-generators ; one of 5,000 k.w. ; three of 10,000 k.w. ; two of 18,000 k.w. ; two of 20,000 k.w. ; and two of 3,000 k.w. for house service supply.


Coal Unloading Transporter, Capacity 100 tons per hour, Riverside Power Station

There are 26 boilers, eight located in No. 1 boiler house, eight in No. 2 boiler house, and ten in No. 3 boiler house, this being the recently completed one built under the 1920 extension scheme.

The equipment of the new super-substation at Fearon Road was almost completed. This substation supersedes the old Fearon Road steam generating station, which is only used now for supplying part of the direct current traction supply to the Tramways Company. In 1924 this old station will be completely shut down and the plant disposed of. Traction supply will then be derived entirely from riverside, conversion from three-phase alternating to direct current being effected at the new super-substation. Another supe-srubstation at Yangchow Road, eastern district, designated " G " substation, is nearly completed and ready for use.

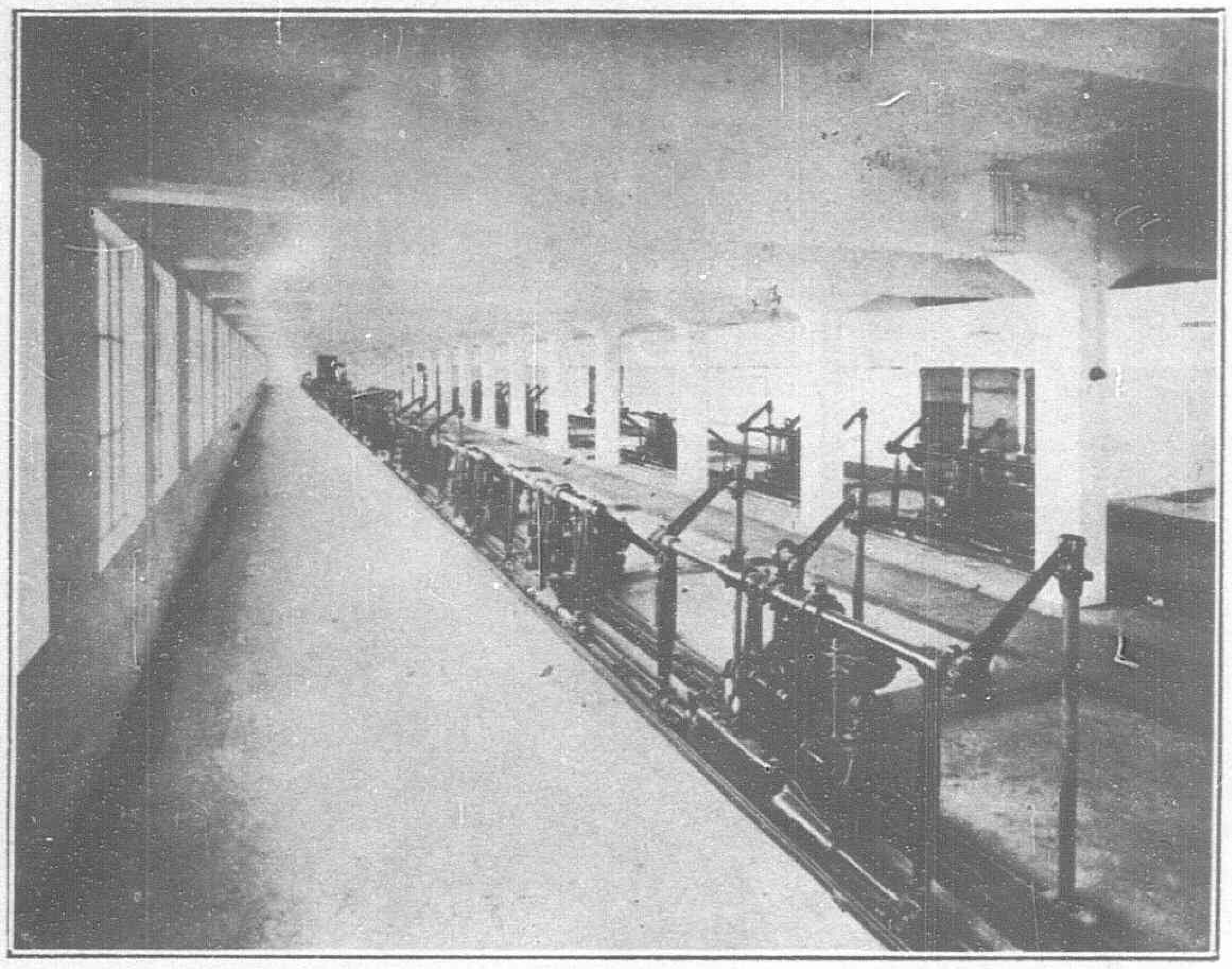

Coal Reclaiming and Stacking Transporter with Coal Conveyor to Boiler House in Background, Riverside Power Station

Kilowatt Hours Generated

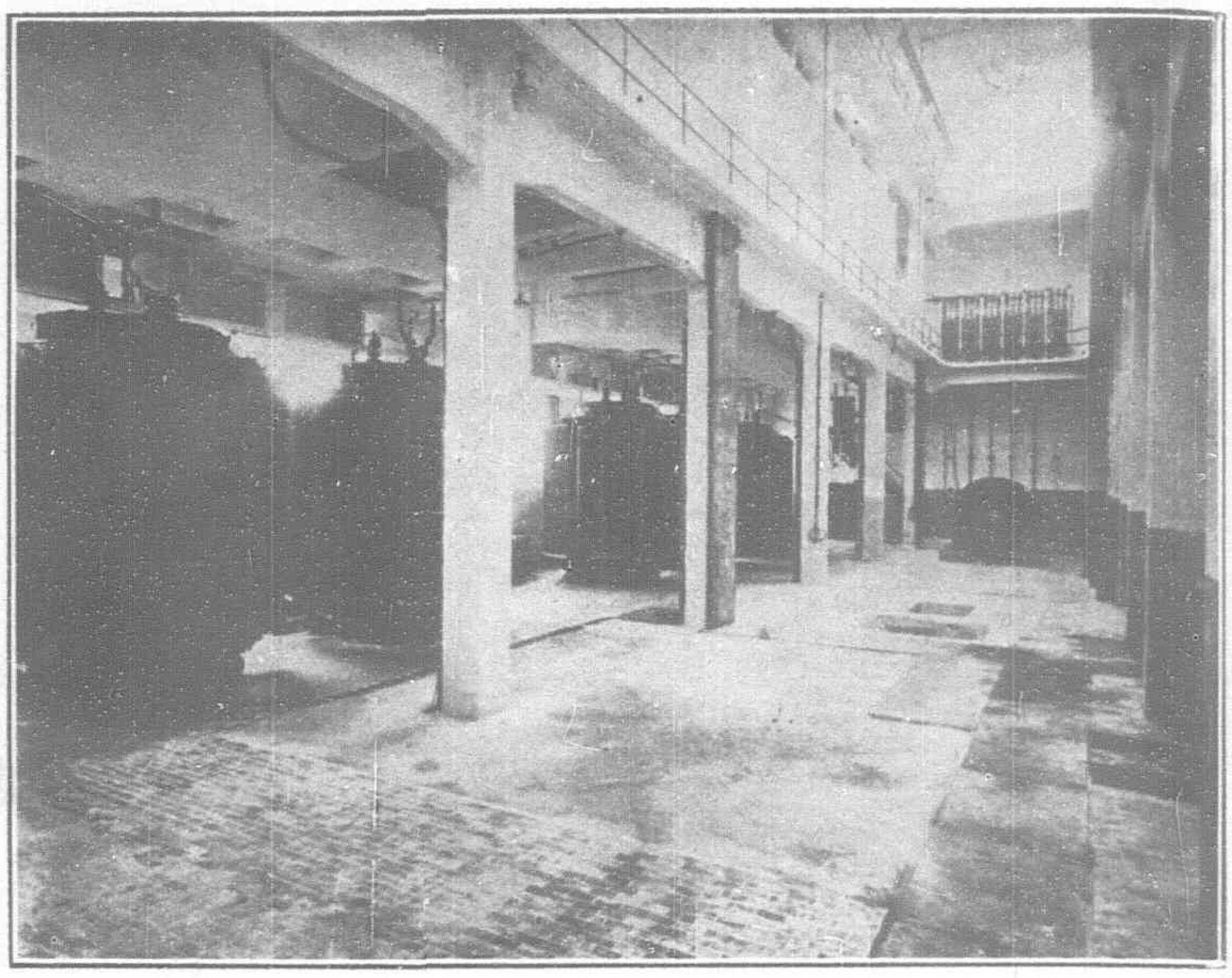
The highest maximum load was 65,632 k.w. The maximum load delivered to the distributing feeders at the same time was 62,903 k.w., an increase of 22.52 per cent. compared with a 25 per cent. increase in 1922 above 1921. The load factor has dropped from 51.5 to 49.42 per cent. The total kilowatt hours generated amounted to 327,876,613, of which riverside accounted for 325,258,465 and Fearon Road 2,618,148 the percentage of the total kilowatt hours generated supplied by Fearon Road being 0.798 only. The kilowatt hours used in both stations directly in the generation of energy were 21,611,482, or 6.59 per cent. of the total generated. The figures for the three previout years were 8.05 per cent., 8.44 per cent. and 6.86 per cent. respectively and 533,381 kilowatt hours were used for miscellaneous purposes such as Fearon Road station lighting, godowns, offices and showrooms, also for office and showroom heating, and energy used by the meter testing department.

Kilowatt Hours Sold

The total kilowatt hours sold amounted to 272,265,861, an increase of 17.12 per cent. over



New 22,000 volt Switch House showing Switchgear Operating Mechanism



Fearon Road Substation showing 4,200 K.V.A. 22,000—6,600 volt, single-phase Transformers and 3,500 K.V.A. Synchronous Condenser

1922 distributed as follows :

	1922	1923	Increase	%
Private lighting	24,793,079	27,626,473	2,833,394	11.43
Public and private street lighting	1,836,419	2,182,615	346,196	18.85
Heating and cooking ...	1,672,459	2,059,774	387,315	23.16
Power	198,549,509	234,419,732	35,870,223	18.06
Traction	5,605,895	5,977,267	371,372	6.62
	232,457,361	272,265,861	39,808,500	17.12

There was a net increase, after allowing for disconnections, of 3,137 additional premises connected to the mains during the year, bringing the total to 39,929 at the end of December. There were 32,921 consumers being supplied at the end of the year, compared with 30,272 at the end of 1922, an increase of 2,649. The new connections added during the year amounted to 17,406 kilowatts. Previously the connected kilowatts represented by public street lighting and the Tramways Company have not been included, but in order to make the total complete these are now for the first time included. They are 341 and 3,960 kilowatts respectively. The total kilowatts connected are now 114,949.

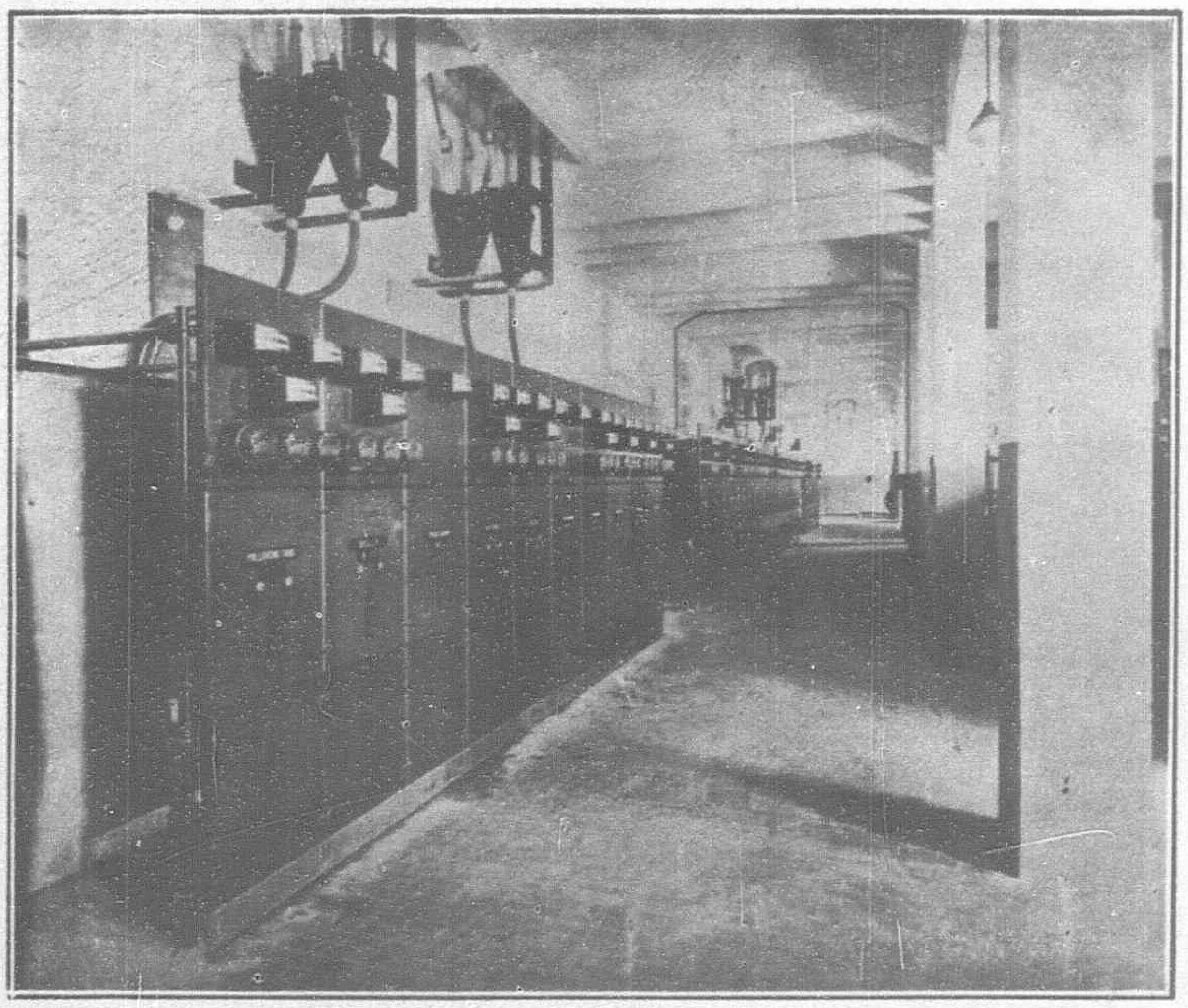
A summary of underground work shows the following additions laid during 1923:—22,000 volt cable, 3.14 miles; 6,600 volt cable, 11.39 miles ; telephone and pilot cable, 8.31 miles ; public lighting cable, 1.60 miles ; and low-tension cable, 4.15, a total of 28.59 of new work making the total mileage 301.40. A net increase of 3,053 miles was shown in overhead work. Public street lighting has increased 11 per cent. during the year, which is an increase of 42 per cent. over the previous year's connections.

The increase in power is as follows :—

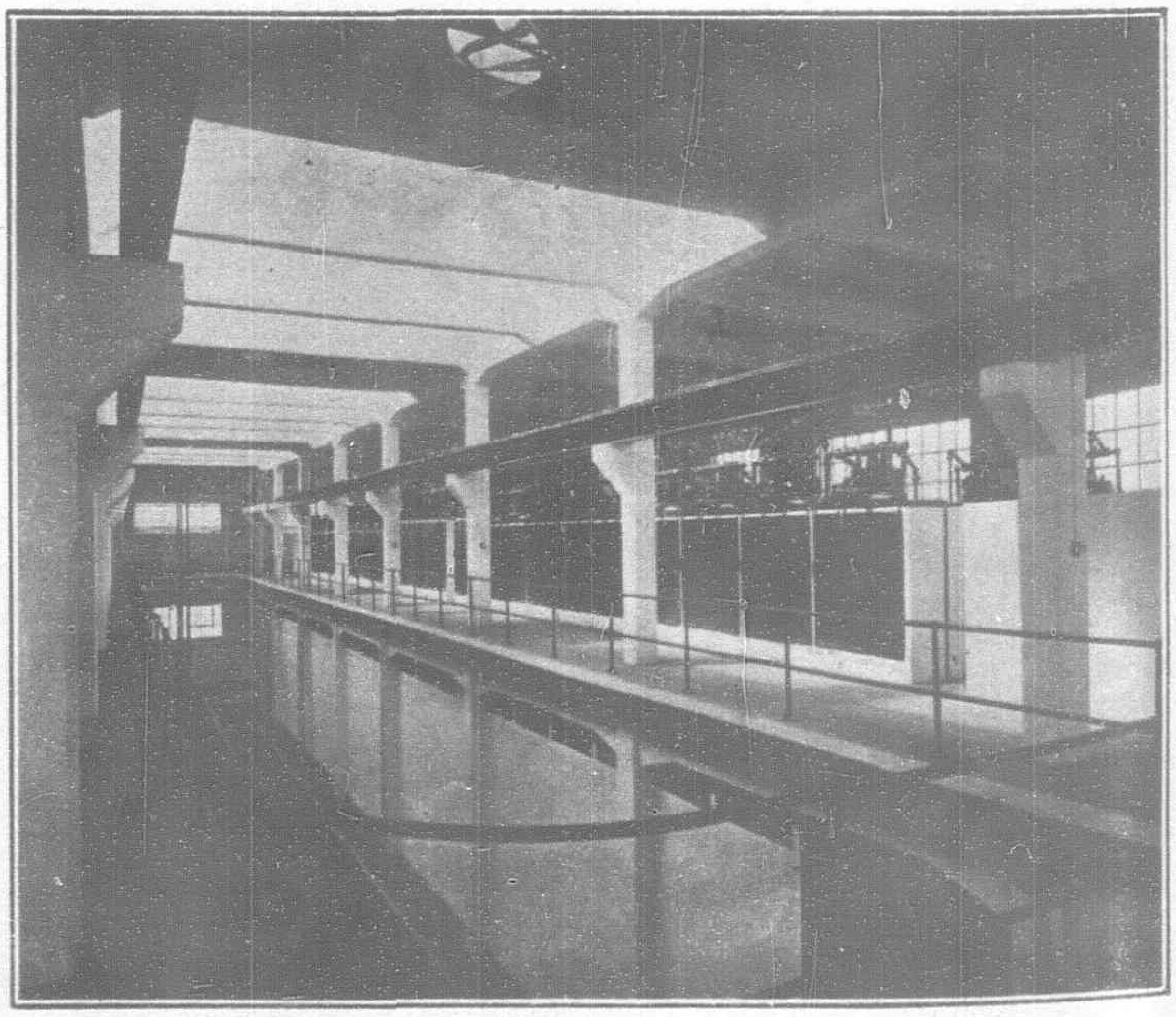
	Number	*Horse-power*
Hired motors disconnected during 1923: ..	67	109.30
Consumers' motors connected during 1923 : ..	914	23,743.12
Net total increase for the year after deductions in respect of disconnections :	847	23,633.82
Total hired motors connected, December, 1923	840	17,373.65
Total consumers' motors	3,636	77,417.28
Total lift and direct current motors connected	329	6,540.65
	4,805	101,331.58

From the 23,743.12 h.p. of consumers' motors connected during 1923 must be taken 5,310 h.p. of motors used in connection with the tramway system in the settlement, which are being recorded as connected load for the first time. This leaves 18,323.82 h.p. and 653 motors as the ordinary net total increase for the year after deductions in respect of disconnections for 1923.

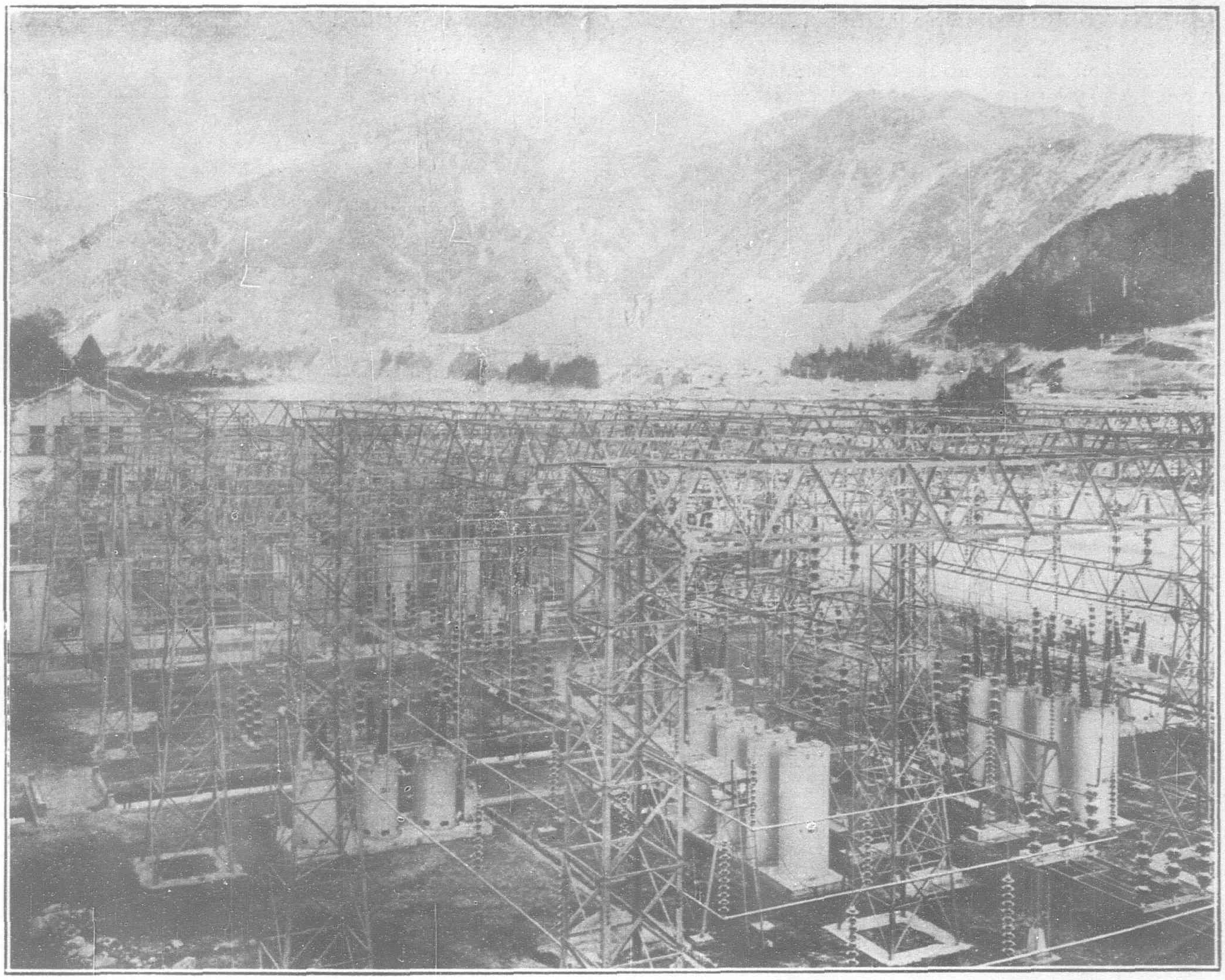
(Continued on page 397.)



Fearon Road Substation showing 6,600 volt, Control Board



Fearon Road Substation showing 6,600 volt, Switch Gallery



SUHARA SWITCHING STATION OF DAIDO POWER CO.
It Controls Two 10,000 k.v.a., 77,000 Volt; Two 15,000 k.v.a. 15,000 Volt; and Two 30,000 k.v.a., 77,000 Volt Incoming lines, also Three 27,600 k.v.a. Transformer Banks of 77,000, 154,000 Volts and Two 55,000 k.v.a., 154,000 Volt Outgoing Lines

Japanese High Voltage Transmission Systems. III*

By S. Q. Hayes, General Engineer, Westinghouse Electric and Manufacturing Co., in the Electric Journal

MOST of the power for the Tokyo district is developed and distributed by the Tokyo Electric Light Co., or some of its subsidiaries. The latest developments are those connected with the delivery of power to the new Kameido terminal station in Tokyo.

The general scheme covers the development of power on the Shinano River (Shinanogawa), Nakatsu River (Nakatsugawa) and Tone River (Tonegawa), for transmitting power at high voltage to Tokyo. Fig. 1 shows the system schematically. Under the name of Shinyetsu Denrioku, a subsidiary company of Tokyo Dento, construction work is under way for the Shinanogawa power house on the Shinano River, and two power plants known as Nakatsugawa No. 1 and Nakatsugawa No. 2 on the Nakatsu River.

The generating equipment and low-tension switching equipment has been, or will be, purchased by the Shinyetsu Denrioku. The step-up transformers and high-tension switch gear have been, or will be, purchased by the Tokyo Dento who will build the transmission lines, starting with two circuits and later adding a third one. Each line is designed for about 75,000 k.v.a. normal capacity, 150,000 k.v.a. emergency rating.

At a point approximately three miles from the Shinanogawa power house, the 1.5 mile branch lines from the Nakatsugawa power house No. 2 will be tapped in. Three miles farther on, lines from the Nakatsugawa power house No. 1, approximately 1.5 miles distant, will be tapped in. From this point, the lines will be continued in two sections, 9 and 15 miles long respectively to the Fujuko switching station. Here arrangements are made for sectionalizing the main transmission lines, and for tying in the five-mile branch line from the Komatsu station of the Tone River development. Here a tie is made by means of three-winding transformers to the 66,000 volt distribution system of the Tokyo Electric Light Co. and to Kohchi, Komatsu, and Kamikuya, three generating stations of the Tone River development. From the Fujuko switching station the lines are continued 22 miles to Maebashi junction.

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*Concluded from page 760 of December 1923 issue.

Two new 154,000 volt steel tower lines are being completed by the Tokyo Electric Light Co. from the Shinanogawa power house to the Maebashi junction, but until the completion of the Shinanogawa power house and the new tie-in transformer station at Komatsu the lines will be operated as far as Maebashi junction at 66,000 volts. The two lines were completed from Maebashi junction to Tokyo in December 1923 and a third 154,000 volt line from Shinanogawa to Tokyo will be completed by October 1926.

The existing 66,000 volt lines, of wooden pole construction, from Maebashi junction into Tokyo will be utilized for the present. Eighteen miles from Maebashi junction there is to be a new switching station (Kumagaya). The lines then proceed a distance of 43 miles toward Tokyo, and then branch 9 miles to Kameido and 10 miles to a future substation at Tabata.

In addition to the power being developed on the Shinano, Nakatsu and Tone Rivers, the Tokyo Electric Light Co. at present receives 40,000 to 50,000 k.v.a., through the Tabata substation of the Inawashiro system. At the Waseda substation, power is received from three small stations known as Fuefuki No. 1, No. 2, and No. 3, each with one 3,000 k.v.a. generator and also from a larger generating station at Komabashi on the Katsuragawa where there are six 3,900 k.v.a. generators.

At the Yodobashi substation, power is received from the Yatsuzawa generating station on the Katsuragawa, containing seven 7,700 k.v.a. generators. There are a few smaller steam plants totaling approximately 19,000 k.v.a. and a few other hydro-electirc power plants which furnish power directly to the Tokyo Electric Light Company's system.

Under the name of Keihin (also a subsidiary of the Tokyo Electric Light Co.) power is delivered at 154,000 volts to a substation near Yokohama, approximately 18 miles from Tokyo. Interconnections exist between the various stations.

Under the name of Gumma Denrioku, a company at present independent, power is delivered to Kawasaki approximately half way between Tokyo and Yokohama. The feeder voltages for Tokyo, Keihin and Kawasaki are so selected as to permit interconnection. The present feeder voltage is 11,000 volts but this will later be changed to 22,000 volts.

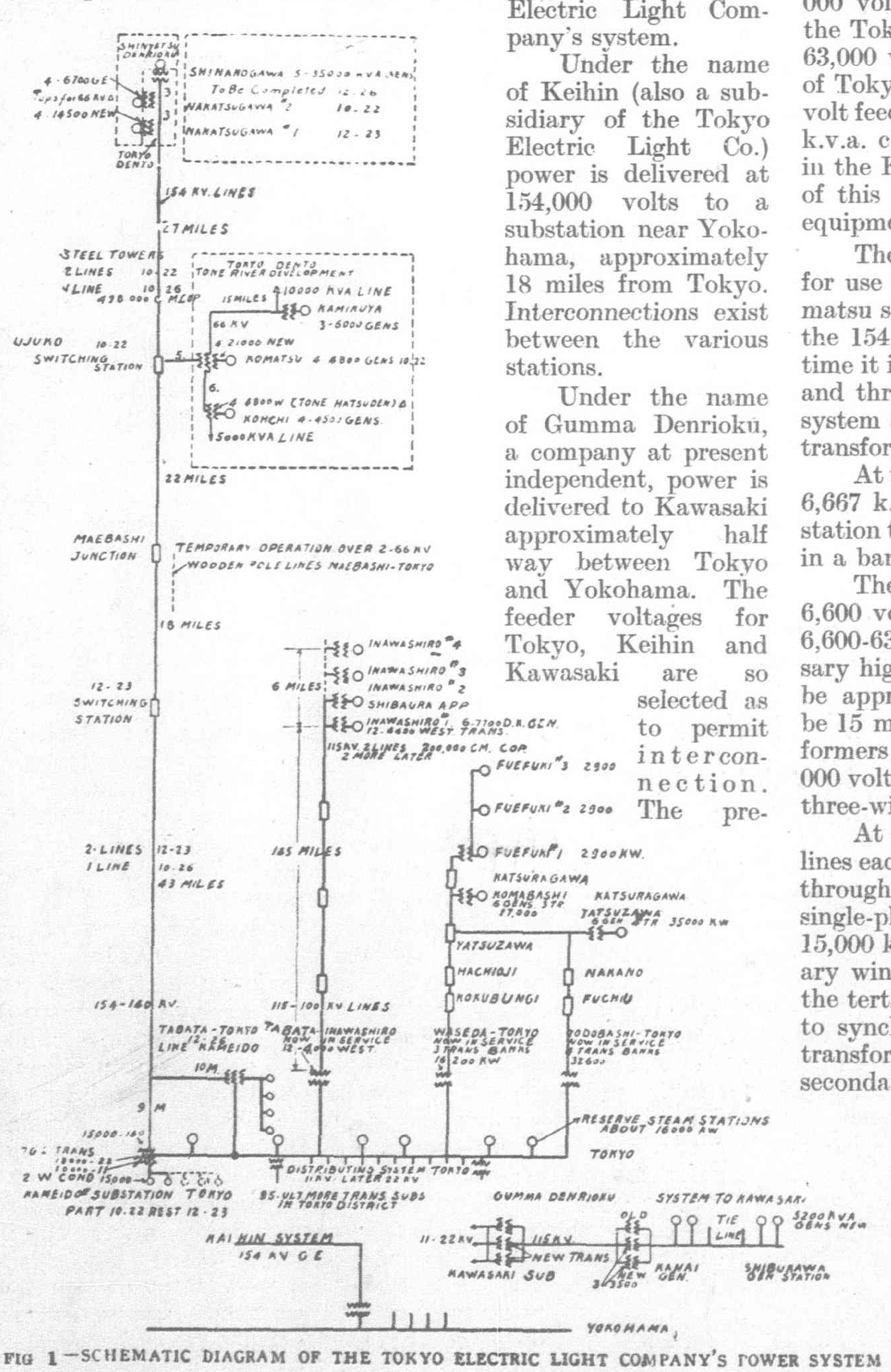


FIG 1—SCHEMATIC DIAGRAM OF THE TOKYO ELECTRIC LIGHT COMPANY'S POWER SYSTEM

Exclusive of Keihin and Gumma, the Tokyo Electric Light Co. will have available by 1926 approximately 400,000 k.v.a. to be delivered to Tokyo, and the Daido Electric Power Co. is contemplating extending their lines to Tokyo, arranging to deliver approximately 100,000 k.w. to Tokyo within the next ten years.

Nakatsugawa No. 2 Station (Shinyetsu Denrioku)

This station contains two 9,500 k.v.a. generators with their exciter equipment. The two generators operating in parallel supply power to a bank of three 6,667 k.v.a. single-phase, step-up transformers, with one spare transformer. The transformers are connected for 11,000 volts delta, 154,000 volts star; but are provided with taps to allow for operation at 66,000 volts delta. A neutral grounding resistor having a capacity to pass 100 amperes for ten seconds has been provided with these transformers.

At the Fujuko switching station, horn break switches of 600 ampere capacity are to be used for cutting off the five-mile line between the Fujuko switching station and the Komatsu transformer station.

Tone River Development (Tone Hatsuden)

For the Komatsu transformer station there are being built four 21,000 k.v.a. single-phase transformers in one bank with one spare transformer. These transformers are to be provided with three windings, one of 21,000 k.v.a. capacity, at approximately 154,000 volts, connecting to the 154,000 volt transmission system of the Tokyo Electric Light Co.; one of approximately 15,000 k.v.a., 63,000 volts which connects to the 66,000 volt distribution circuit of Tokyo Electric Light Company, and ties in, by means of 66,000 volt feeders, to the Kamikuya and Kohchi stations; and one of 6,000 k.v.a. capacity, 6,600 volts is for the circuits from the generators in the Komatsu station. The switching equipment for the control of this transformer bank will form an addition to the switching equipment now installed at the Komatsu power generating station.

The six 4,800 k.v.a., 6,600-63,000 volt transformers, supplied for use as two star-connected 110,000 volt banks, now in the Komatsu station, will be used, connected in delta, at 63,000 volts until the 154,000 volt transmission line is put into operation. At that time it is likely that three transformers will be shifted to Kamikuya and three to Kohchi where they will feed the 66,000 distribution system and tie in on the 66,000 volt windings of the 21,000 k.v.a. transformers that will replace them at Komatsu.

At the Kamikuya generating station there will be installed three 6,667 k.v.a., 6,600 volt, three-phase, 50-cycle generators. In this station there will be utilized three 4,800 k.v.a. transformers arranged in a bank stepping up from 6,600 volt delta to 63,000 volt delta.

The station at Kohchi will probably contain four 4,500 k.v.a. 6,600 volt generators, three 4,800 k.v.a. single-phase transformers, 6,600-63,000 volts delta, transferred from Komatsu, and the necessary high- and low-tension switching equipment. This station will be approximately six miles from Komatsu, and Kamikuya will be 15 miles from Komatsu. Possibly at some later date, tie transformers may be located at Maebashi for connecting together the 154,000 volt and the 66,000 volt circuits, although it is probable that the three-winding transformers at Komatsu will perform this function.

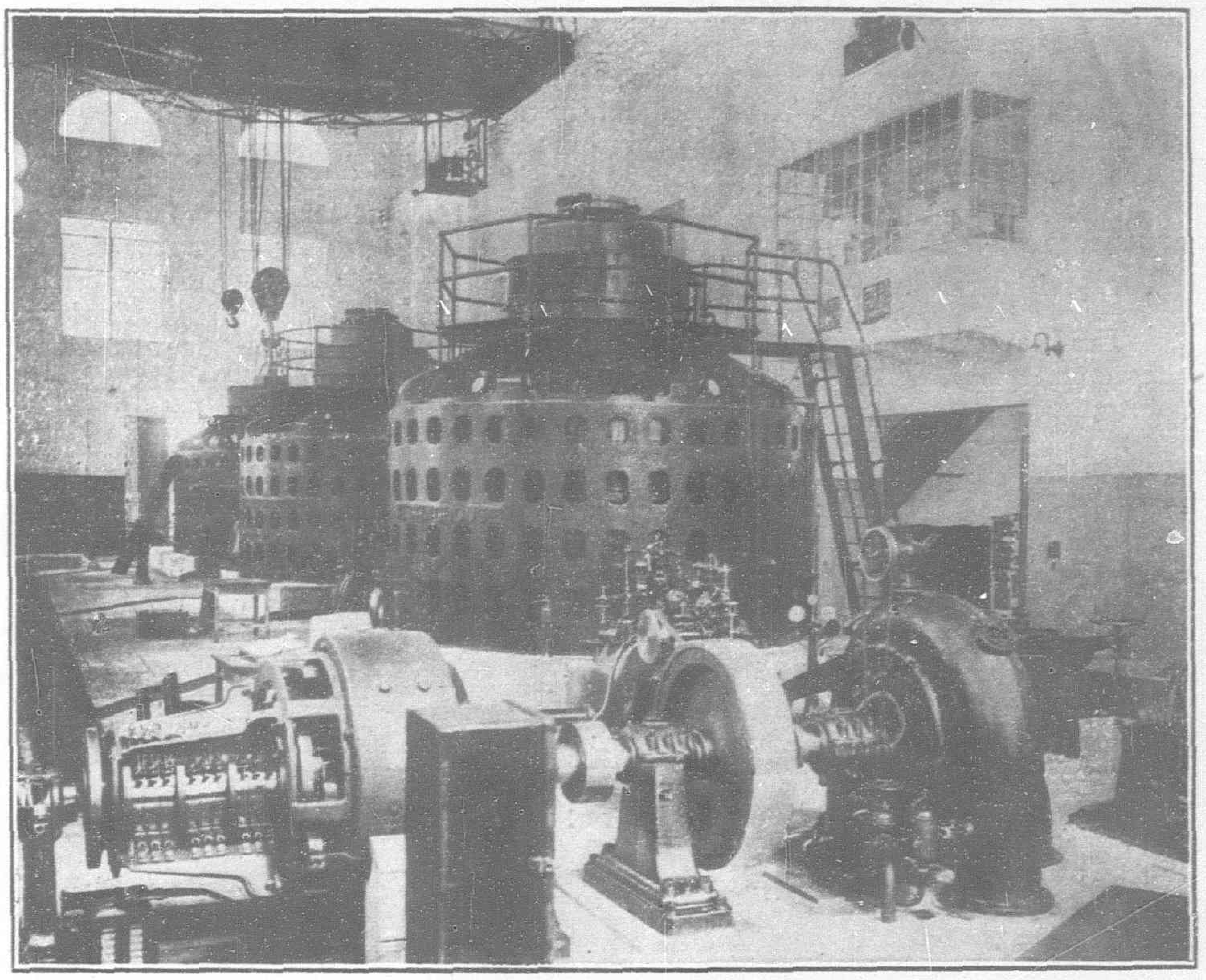
At the Kameido station there are two 140,000 volt incoming lines each of approximately 75,000 k.v.a. capacity. These lines feed through three transformer banks, each bank comprising three single-phase units with three windings. The primary winding of 15,000 k.v.a. capacity will be used for the incoming line, the secondary winding of 18,000 k.v.a. capacity for power distribution, and the tertiary winding of 10,000 k.v.a. capacity for supplying current to synchronous phase modifiers. The primary winding of these transformers will be connected in star for 140,000 volts. The secondary winding will be connected in star to operate temporarily at 11,000 volts for power distribution, but arranged for ultimate operation at 22,000 volts. The tertiary winding, connected in delta, is so designed that one bank of transformers can be used with two 15,000 k.v.a. synchronous phase modifiers.

The general scheme of operation contemplates utilizing synchronous phase modifiers in such a manner as to maintain 11,000 or 22,000 volts on the secondary winding of the transformers, this corresponding with approximately 140,000 volts on the primary.

In the Kameido station there are installed two 15,000 k.v.a. synchronous condensers. Each of these condensers is provided with a 145 k.w. direct-connected exciter and a 1,000 h.p. wound rotor starting motor. For use with the synchronous condensers and their exciters respectively are provided motor-operated field rheostats, field discharge resistors, control panels for the motors, and oil pressure pump outfits for the synchronous condensers. For supplying the voltage to start the synchronous condenser or for driving the motor, there are two step-down transformers having a nominal rating of 1,800 k.v.a. each. The connections to the synchronous phase modifier are made so that the tertiary windings of transformer banks Nos. 1 and 3 can be connected either to the 11,000 volt bus or directly to one of the synchronous phase modifiers, while the connections for transformer bank No. 2 are made to the bus.

The station building is arranged to house the two present and the three future phase modifiers as well as the local service transformers, the starting transformers and all of the switching equipment for the 11,000 and 22,000 volt circuits.

All of the 11,000 and 22,000 volt circuit breakers are of the cell type and, to facilitate the work of the concrete contractor, scale models were made up of most of the structures and the circuit breakers, disconnecting switches and the bus bars supports. The connections were all made up in miniature.



Three 17,000 k.v.a. Generators, 60 Cycle, 6,600 volt in Yamikiki Generating Station of Daido Power Co.

There are two 22,000 volt power bus structures, one 11,000 volt structure for the running connections of the synchronous phase modifiers and a 2,700 volt structure for the starting bus.

From the Kameido station, power distribution is made by means of underground cables at 11,000 volts, later to be changed to 22,000 volts. These main feeders supply power to various substations and can be connected to corresponding feeders from the Yokohama substation of the Keihin Company and the Kawasaki substation of the Gumma Electric Power Company.

The interconnections of the various receiving stations in Tokyo and the different substations are shown on Fig. 2. The data relative to the stations of the Tokyo Electric Light Company, approximately correct to end of 1921 can be summarized as follows:

Reserve Steam Plants—Asakusa 4,000, Enoshima 225, Kanagawa 14,500, Yokosuka 850; total 19,575 kw.

Present Water Power Plants—Fuefuki 9,000, Iwamuro 18,000, Kamikuya 2,400, Kifune 550, Komabashi (Katsuragawa) 19,500, Minowa 3,500, Takatsudo 350, Tomosawa 3,300, Tsuchimura 14,000, Yatsuzawa (Kat suragawa) 48,200; total 118,800 kw.

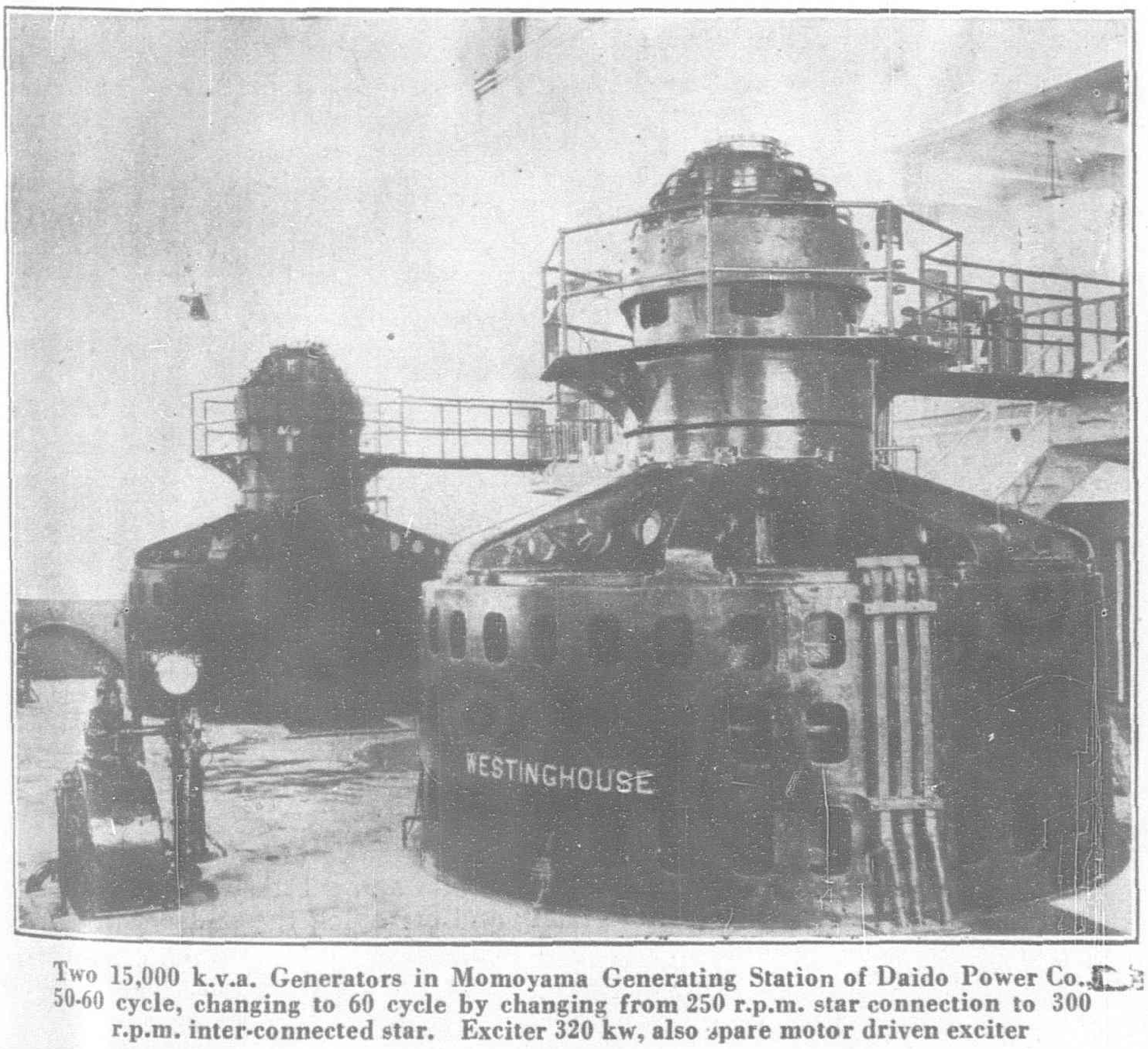
Purchased Power—Akigawa 70, Chiba 810, Fuzigasu 12,000, Goida 350, Gumma 50, Inawashiro (Tabata) 40,070, Ishioka 200 'Katsuragawa 11,000, Keio 500, Keisekido 470, Kinugawa 10,650, Nishige 300' Shitana 650, Tsuru 700, Teiko Kulengo 2,000; total 79,400 kw.

Total power available at end of 1921 ...	217,775	kw.
Under Construction :—		
Nakatsugawa No. 2 for completion 1922	20,000	,,
Komatsu for completion 1922	19,200	,,
Total for completion 1922	39,200	,,
Nakatsugawa No. 1 for completion 1923	43,500	,,
Kochi for completion 1923	18,000	,,
Total for completion 1923	61,500	,,
Kamikuya for completion 1926	18,000	,,
Shinanogawa for completion 1926 ...	175,000	,,
Total for completion 1926	193,000	,,
Total power available at end of 1926	511,475	,,

The present transmission lines of the Tokyo Electric Light Co. terminate at Yodobashi and Waseda; the Inawashiro lines at Tabata, the Katsuragawa and Kinugawa lines at their own substations, the voltage being stepped down to 11,000 volts for transmission to various substations and large customers.

The new lines of the Tokyo Electric Light Co. will terminate at the Kameido terminal station, which will be partly completed by the end of 1922 and finished by the end of 1923, and the new Tabata terminal station. Equipment now on order for the Kameido terminal station comprises three 45,000 k.v.a. transformer banks, and two, later five, 15,000 k.v.a. synchronous phase modifiers. The new Tabata terminal station will have about the same equipment.

Substations installed at the end of 1921 amounted to 82 in number, making a total installed k.w. capacity of 219,810 k.w. Present interconnections between substations are made at 11,000 volts (later 22,000) with distribution at 3,500 volts. Twenty-one large customers take 26,410 k.v.a. at 11,000 volts.



Two 15,000 k.v.a. Generators in Momoyama Generating Station of Daido Power Co., 50-60 cycle, changing to 60 cycle by changing from 250 r.p.m. star connection to 300 r.p.m. inter-connected star. Exciter 320 kw, also spare motor driven exciter

While there are many interesting features connected with the different transmission lines into Tokyo, the Inawashiro system is particularly notable as being the first system in Japan to operate at a potential higher than 77,000 volts and the only plant so to operate until very lately. Many of the engineers now prominent in the various power transmission companies of Japan have been connected with the Inawashiro system and obtained their first high-tension experience with that Company.

Inawashiro Hydro-Electric Company

The Inawashiro Hydro-electric Power Company has four power sites on the Nippashi River, the outlet of Lake Inawashiro, and transmits power a distance of about 145 miles to Tokyo with a voltage at the generating stations of about 115,000 volts and at Tokyo of about 100,000 volts.

For the first plant, the water is diverted from the river, shortly after it leaves the lake, and is taken in an open canal varying in width from twenty to thirty feet, with an average depth of about 13 feet. Several hills are pierced by tunnels, and across some of the valleys the canal is carried on bridge construction. The canal ends at a large settling basin, or forebay, and a separate penstock of welded steel pipe 75 to 87-in. diameter, 1,420 feet long, is provided for each of the six generator units, and a single penstock 25.5-in. in diameter, 1,420 feet long is provided for the exciter wheels. The penstocks are held in seven massive concrete anchorages, wherever there is a change in the slope. Three of these anchorages are hidden by the building. The overflow from the forebay is to the right of the penstocks. The line supplying power to the headgate house as well as the steps and path leading from the power plant to the forebay, are at the left of the penstocks. The hoods over the ventilating ducts which supply cold air for the generators are between the lower windows.

Power station No. 1 contains six 10,000 h.p. Francis horizontal shaft waterwheels, running at 375 r.p.m., under a head 350-ft., of each driving a 7,000 k.w, 7,777 k.v.a., 6,600 volt, three-phase, 50-cycle generator. There are also four 300 h.p. impulse type waterwheels running at 600 r.p.m. each driving a 200 k.w, 250 volt exciter with voltage controlled by automatic regulators.

The generating station also contains four banks of step-up transformers, each comprising three 4,400 k.v.a. units connected delta-delta 6,600 to 115,000 volts. These transformers are of the indoor type and arranged in compartments which are provided with steel roller doors. Each transformer is mounted on a truck so that it can readily be rolled out into the generator room to be handled by a crane.

The step-up transformers in station No. 2, feed into two 115,000 volt tie lines connecting to station No. 1. It was the original intention, when this system was first designed, that stations Nos. 3 and 4 should also be connected to the tie lines running to station No. 1, which was to be the controlling point for the power generated in all four stations. From station No. 1, there are now two three-phase, 115,000 volt outgoing circuits transmitting power to Tokyo. The original scheme called for four outgoing circuits and two incoming tie lines fed from the other three stations. While the equipment for station No. 2 followed out the original plan, and the transformers in that station feed directly into two lines connecting to station No. 1, it is very probable that the plan for stations No. 3 and No. 4 may be considerably modified, and that a higher voltage, very likely 154,000, will be utilized for the additional lines to Tokyo.

Generating station No. 1 now contains its full ultimate equipment, except that provision may have to be made for some additional high-tension circuits, when the two additional generating stations are installed. At three points along the transmission line, namely, Shirakawa, Utsunomiya and Koga, intermediate outdoor switching stations are installed for sectionalizing the two present transmission lines and provision is made for sectionalizing two future transmission lines.

The receiving station at Tabata in the outskirts of Tokyo, was originally arranged for two incoming 100,000 volt lines. Twelve 4,000 k.v.a., single-phase, 50-cycle transformers arranged in four groups of three each, step down from approximately 100,000 to 11,000 volts. The equipment of this receiving station will be practically doubled in size when the additional generating stations are installed. If a higher voltage is used for transmitting power to Tokyo, it is very likely that the new transformers will be arranged for outdoor service, whereas if the voltage is maintained at 115,000 volts, indoor equipment may be utilized.

In 1913, the order for the transformers, covering twelve 4,400 k.v.a. and twelve 4,000 k.v.a. units or a total of 100,800 k.v.a., was the largest order placed at one time for transformers, particularly for high voltage service. All of these transformers are single-phase, 50-cycle, and are connected delta-delta. In order to take care of the low-voltage alternating-current circuits needed at the generating station, and at the receiving station for light and power service, there are two 150 k.v.a., three-phase, 50-cycle transformers installed at each station.

In order to insure the dryness and purity of the oil used for insulating the transformers, oil circuit-breakers, and lightning arresters, oil-treating outfits have been supplied for the generating and receiving stations, to keep the oil free from moisture and sediment. Each of these outfits consists of a filter press with a capacity of 10 to 12 gallons per minute and a rotary pump. To facilitate filling and emptying the tanks of the transformers, circuit-breakers and arresters, a very complete piping system was installed and equipped

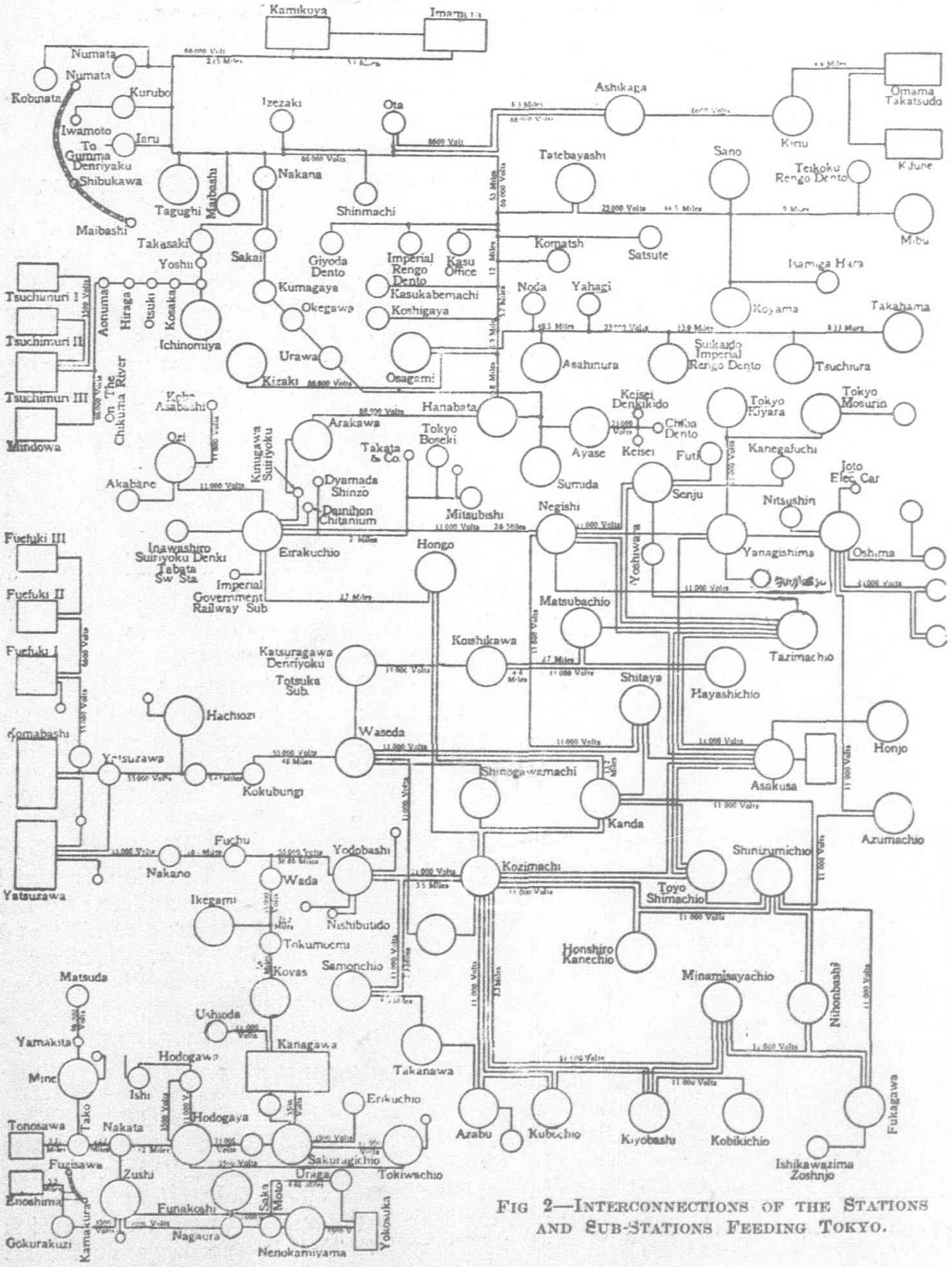
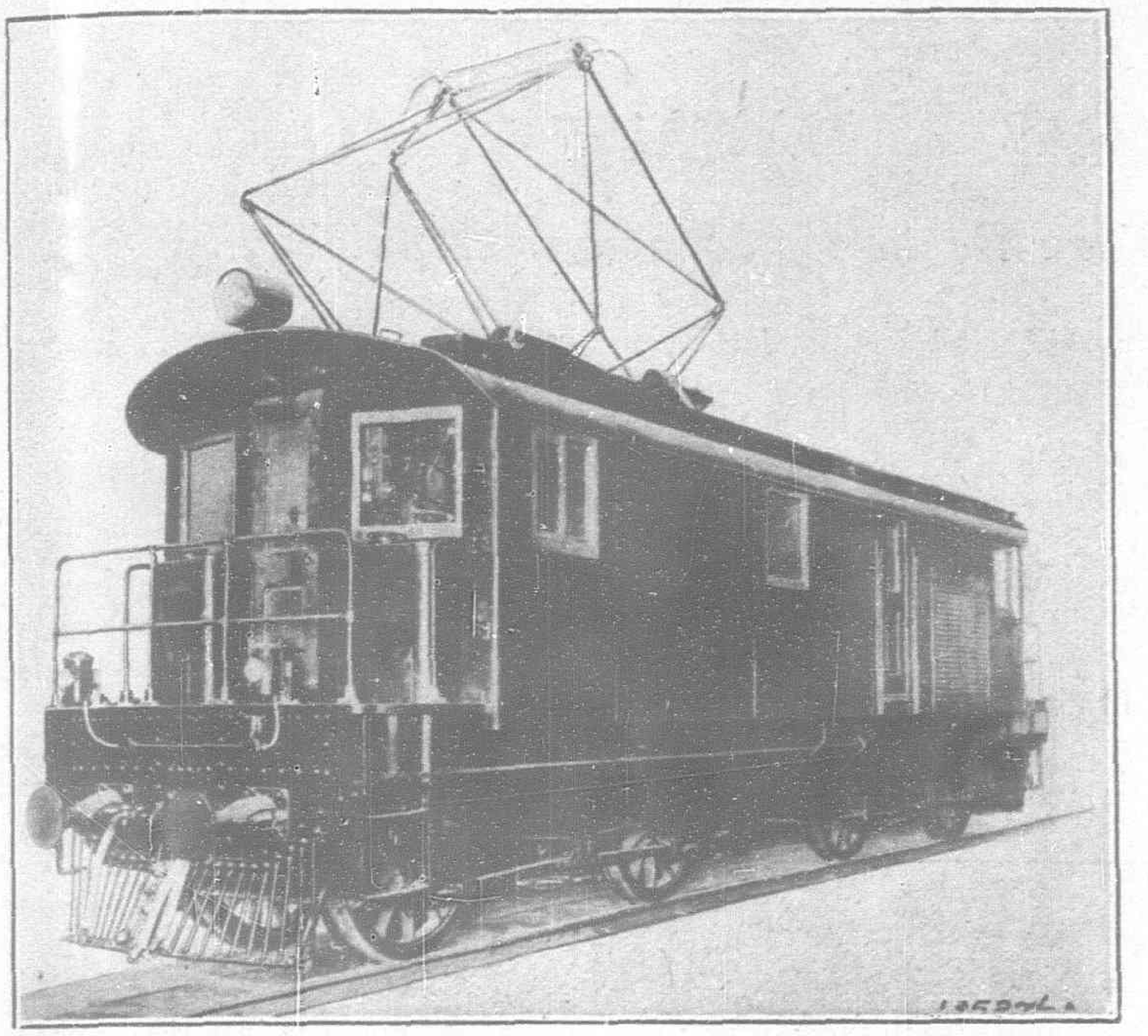


FIG 2—INTERCONNECTIONS OF THE STATIONS AND SUB-STATIONS FEEDING TOKYO.



JGR Loco—040 by 040—Freight Service 55 met. tons. First sample loco. to arrive in Japan. Delivered Dec. 1922. 1,200 H.P. on 1,500 volts arranged for operation on 600 volts, 1,200 volts and 1,500 volts, 49″ drivers, rigid wheelbase 9′ 1″. Length over buffers 40′ 7″, width over all 9′ 2″. Motors 300 H.P. 750 volts two in series, 1,500 volts direct geared through spring gear, Field Control. Control: Gear ratio 16/72. Westinghouse Type HLF. Unit Switch. The only locomotive furnished which is arranged for the installation Regenerative Braking, space being left in the cut and circuit arrangements made so as to provide for

with a direct-acting 4 by 6-in. tripl expump having a capacity of approximately 50 gallons per minute.

As the high-tension switching and transforming equipment in the Inawashiro generating station and the Tabata receiving station is of the indoor type, provision was made for taking the high-tension leads through the roof by means of a condenser type roof bushing.

In the generating station, the five alternating-current generators are each provided with two electrically-operated oil circuit-breakers, one of which connects the generator to the main 6,600 volt bus, while the other connects the generator to the 6,600 volt auxiliary bus, which is used to supply current to four transformer banks, each consisting of three 4,400 k.v.a. single-phase transformers. On the high-tension side of the step-up transformers, circuit-breakers are provided to make connections to the high-tension ring bus, which supplies the 115,000 volt feeders. The various 6,600 and 115,000 volt bus-bars are sectioned at various points by oil circuit-breakers and disconnecting switches. A water rheostat connects through a breaker to the 6,600 volt main bus in such a way that it can be used to load any machine.

The control desk for the generating station, Fig. 19, comprises a pipe frame work having mounted on it nine sections of marine finished slate, containing the various controllers, indicating lamps, etc. A separate instrument frame is furnished, supported by pillars from the control desk, containing the various meters required for the installation. The rear of the desk and instrument frame is made of expanded metal construction. The central section of the desk is four feet wide, while the remaining sections are each two feet, so that the total length of the board allowing, for the end pieces, is slightly over 20-ft.

All of the controllers and indicating lamps for the direct-current system are placed on the front of the desk, while the controllers and similar devices for the alternating-current circuits are located on the horizontal top slab of the desk. A complete miniature busbar system is placed on the desk to show the connections made by the various breakers; red indicating lamps being connected into the miniature busbar system in such a manner that they light up when their particular breaker is closed. The miniature high-tension bus on the horizontal slab of the desk is nickel plated and the corresponding low-tension bus is finished in polished copper to make it easier to distinguish them. The miniature direct-current busbars are on the front part of the desk, and these are also copper finished, but their location suffices to distinguish them from the other busbars.

In the switchboard room adjacent to the control desk, there are installed three 12 drop annunciators. One annunciator is connected to the thermometer signal devices on the main power transformers, in such a manner that a drop will be actuated and the bell rung in case the temperature of any of the 12 main transformers exceeds a predetermined limit. The second 12 drop annunciator is used to indicate the cessation of the flow of cooling water for any of the 12 transformers. The third annunciator is used in connection with the lightning arresters in the two 115,000 volt circuits and the four 6,600 volt circuits, the drop being actuated and the bell rung in case of a discharge on any of these six arresters. This annunciator is provided with six additional drops to take care of future circuits.

The switchboard for the control of the four 200 k.w., 250 volt exciters and the field circuits of the six generators hes two panels for the field circuits of the generators each contain six two-pole solenoid operated field discharge switches used in pairs for connecting the field circuits of the generators to either of two sets of field busbars. These field switches are electrically interlocked in such a way that only one can be closed at a time. The four remaining panels, which control the armature circuits of the exciters, each contain two two-pole solenoid operated carbon break circuit breakers so arranged that any exciter can be connected to either of the two sets of busses, and the breakers are interlocked so that the exciter can only be connected to one bus at a time. On the two central panels of the board there are two two-pole single-throw knife switches for sectionalizing the two exciter busses.

In addition to the main control desk with its indicating instruments, a panelboard is furnished containing the various watthour meters, graphic recording meters and relays required for the various circuits. Calibrating receptacles are mounted on small slabs on the rear of this board to provide means for checking and testing the meters and relays. Similar equipment is furnished for the control desk.

The waterwheels of the Inawashiro generating station are on the side of the power house away from the incoming penstocks which pass under the electrical section of the station, while the generators are located on the side nearest the electrical part. Suitable cold air inlets are provided for each generator, and similar outlets are furnished for discharging the air from these machines outside the building.

The transmission lines, from the generating station at Lake Inawashiro to the receiving station near Tokyo, follow closely the main highway which parallels the railway. While there are a number of river crossings where special towers are used, ordinarily the standard towers are employed for the straight portions of the line. These towers measure 72-ft. 9-in. from the ground to the top cross-arm which carries the ground wires. The first cross-arm carrying power wires is 4-ft. 9-in. lower, the middle cross-arm for power wires is 10 feet below this, and the bottom cross-arm is 10 feet farther down or 48-ft. from the ground.

The ground wires, two top power wires and two bottom power wires are 19 feet, 6-in. apart horizontally, while the middle power wires are 23-ft. 6-in. apart. One power circuit is on each side of the main tower, the wires being in the form of a flattened triangle, the top and bottom wires being 20 feet apart, and the middle wire 2-ft. to one side of the vertical line joining top and bottom wires. The small house inside the tower is used as a telephone booth and a storage space for spare insulators.

The normal tower spacing is 550 feet and the longest span, that across the Tone River, is 1,530 feet, this span being supported on towers 220 feet high. The conductors on the normal portion of the line are seven strand copper, 200,000 circ. mil, the ground wires being $\frac{3}{8}$-in. steel cables. At the Tone River crossing, $\frac{5}{8}$-in. seven strand steel cables are employed, these being anchored at the end by three groups of eight section insulators connected in parallel. The normal suspension insulators are arranged seven in a string. The American porcelains originally supplied have nearly all been replaced by those of Japanese manufacture.

Japanese Imperial Government Railways

The government railways of Japan are laying plans for very extensive electrification along the main Tokaido line that joins the city of Tokyo to the city of Kobe approximately 350 miles away. The first part of the electrification to be undertaken will be from Tokyo to the mountain section near Mt. Fuji, and for this work 1,500 volt direct-current will be employed on the trolley.

The Singapore Water Supply Project

By Stephen G. Williams, M. Inst. C. E., Water Engineer of Singapore Municipality

THE first public reference to the possibility that Singapore town would need to go to the Johore mainland for its water supply, occurs in the report by Mr. Robert Peirce, M. INST. C.E. (then Municipal Engineer), made in 1904, upon the Kalang and Seletar Water Schemes. He there stated that upon the completion of the Kalang and Seletar Schemes, the water resources of Singapore Island would, for all practical purposes, be exhausted.

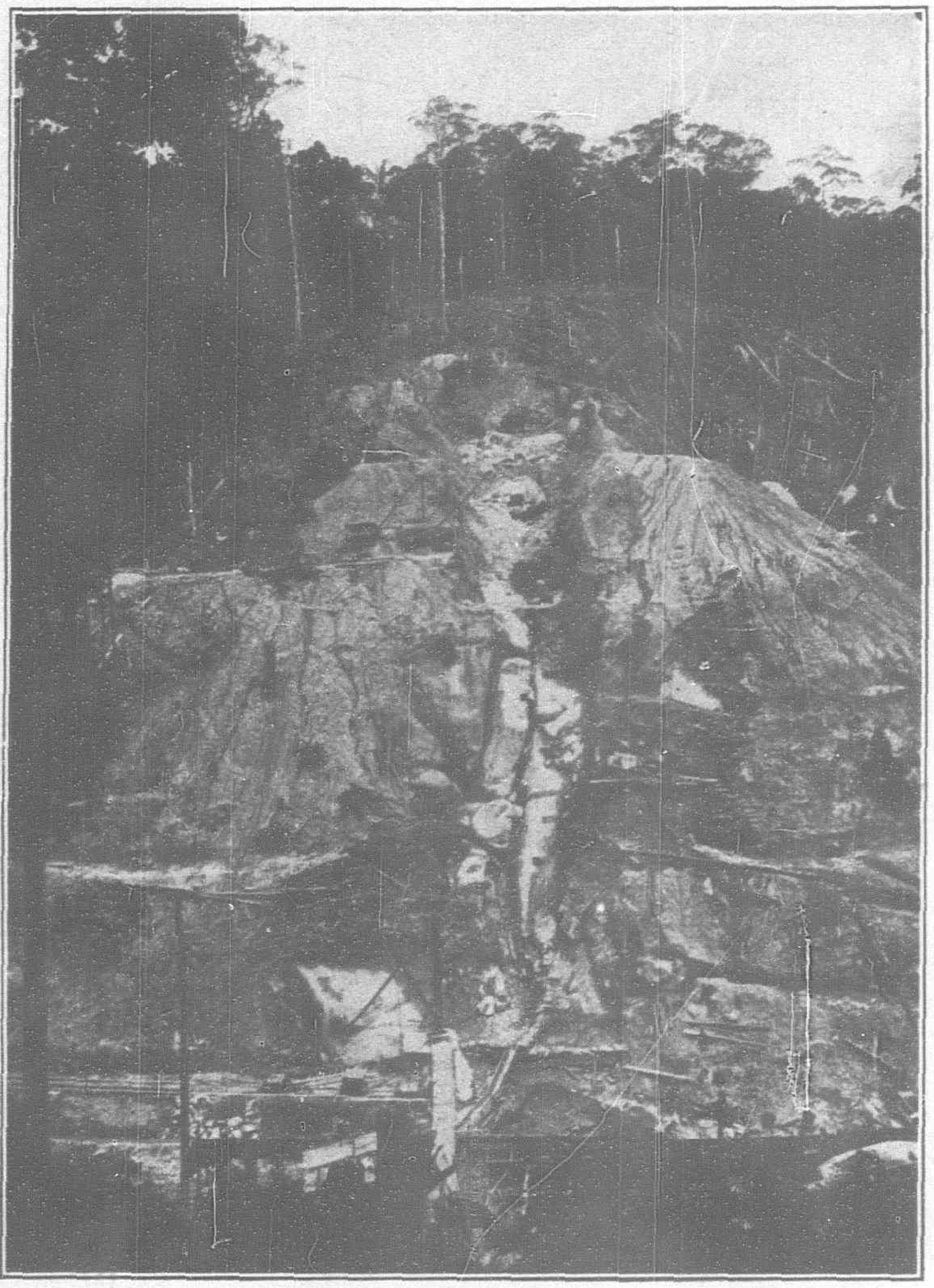
During the succeeding eight years, various waterworks were under construction, including the Kalang Scheme, but in the year 1912, Mr. Peirce visited the Pulai district in Johore, and also entered into negotiation with the government and the F.M.S. Railways for the provision of space for a large water main upon the iron bridge, which it was then proposed to construct across the Johore Straits.

In the following year 1923, Mr. Peirce received by correspondence information with regard to the water resources of the Sungei Lenggiu and the Sisik Bahru, both of them tributaries of the Johore River.

In the year 1919, government decided that communication across the Johore Straits should be by means of a granite causeway, and arrangements were made with them, and with the F.M.S. Railways, for the accommodation of a water main upon the causeway, and under its lock.

In September, 1920, the municipal commissioners, with the consent of the Johore government, decided to make a thorough investigation of the water resources of the southern portion of Johore State, and that work was entrusted to the writer.

It was hoped that water would be found at a sufficient elevation to be delivered into Singapore by gravity, without the need of pumping. Investigations were therefore in the first instance directed to the mountain ranges of Pulai to the west, and Muntahak to the north of Johore Bahru.



PULAI II DAM SITE

Bedrock Granite Exposed Along Centre Line of Proposed Dam

Pulai Explorations

Gunong Pulai is an isolated mountain, over 2,000 feet in height, rising out of the plain in the form of an irregular cone, with a base some 21 square miles in extent; its surface being broken up into many ridges and valleys, down which, in all directions, the streams descend as mountain torrents.

In the course of the exploration of the Pulai area, it was amazing to find, in most inaccessible places, traces of former occupation by Chinese pioneers, who had apparently ascended the valleys many years before in search of tin, or in the hope of finding suitable spots for the planting of gambier or pepper.

At the present time only the fringe of this mountain area is penetrated by natives usually engaged in collecting rotans and jungle produce. Until the time of our visit, the interior was unexplored except along one line where a pathway had once been opened up for Sultan Abu Bakar. This pathway, though long overgrown, could be traced here and there, having been occasionally used by trigonometrical survey parties visiting the summit of the mountain.

It was necessary first to cut access rentices through the virgin jungle in order to reach the water courses at the foot of the mountain, and then to traverse each water course to ascertain its volume, and the possibility of obtaining storage in its valley.

When the more important water courses had thus been located, survey work was undertaken, and stream gauges and rain gauges were established at suitable points. No former survey work had been done in this area.

Much help was obtained from managers of estates surrounding the mountain, and all available rainfall figures were collected from them. Rainfall and discharge figures were also obtained from Penang Hill, for comparison with the observations being made upon Pulai.

The study of the natural features and the geology of the district, and the establishment of reliable stream and rain records on so extensive an area, was necessarily a slow process.

One Practicable Mountain Site

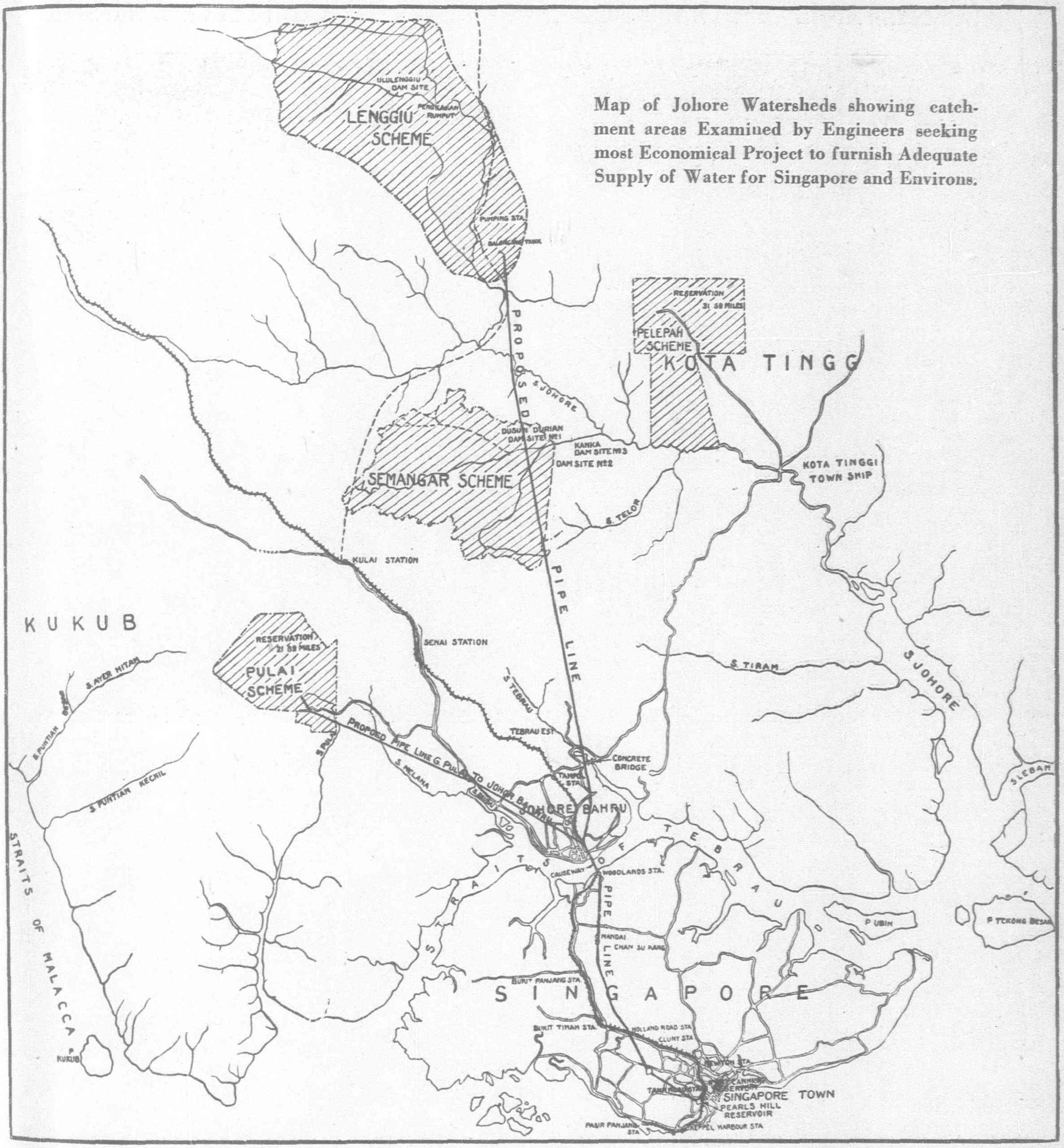
Preliminary reports were placed before the commissioners in 1920, 1921 and 1922, and the final report on September 1, 1922.

By this last date, it had been discovered that only one practicable site was available upon the mountain, suitable for the construction of an impounding reservoir, high enough in level to discharge by gravitation to Singapore, that site being on Sungei Pulai II, and combining the flows from the streams known as Pulai II and Pulai III. Any further supplies to be taken from Gunong Pulai would have to be obtained by pumping.

It was found also that the works necessary for developing the Pulai II Site would comprise a masonry dam across the Pulai II River, a subsidiary dam adjacent thereto, and an intake upon Pulai III River, with a tunnel to discharge the flow from that stream into Pulai II.

Borings had already been put down on the sites of these various works to ascertain the nature of the foundations available, and careful detail surveys of the sites were at once commenced for use in the preparation of the final designs.

At the site of the main dam on Pulai II, a trench was excavated across the valley on the line of the proposed dam. On one side of the valley solid granite foundation was found very near the surface. The other side of the valley, however, showed disintegrated granite soil, full of enormous core boulders extending to a very great depth. Excavation by ordinary methods was conducted until the depth of the trench, and the difficulty of dealing with the core boulders became prohibitive. An hydraulicing plant was then installed, and excavation was continued by washing out the earth surrounding the core boulders, thus loosening the boulders, which were then broken by blasting and removed from the trench.



Map of Johore Watersheds showing catchment areas Examined by Engineers seeking most Economical Project to furnish Adequate Supply of Water for Singapore and Environs.

This work presented great difficulties and occupied many months, but eventually it proved that a satisfactory foundation for a masonry dam could be obtained at a practicable depth. During this excavation work, the advice of the government geologists was sought from time to time, and they visited the works on several occasions, and reported thereon to the commissioners.

By September 1, 1922, when the final report upon Pulai was presented, the scheme had taken its final form, and a month later the Consulting Engineers, Messrs. Sir Alex. Binnie, Son and Deacon, visited the site and endorsed the proposals which had been put forward.

During 1923, further surveys, chiefly upon the lower lying, surrounding areas, were made, and the method of developing the later pumping instalments of the Pulai Scheme was settled.

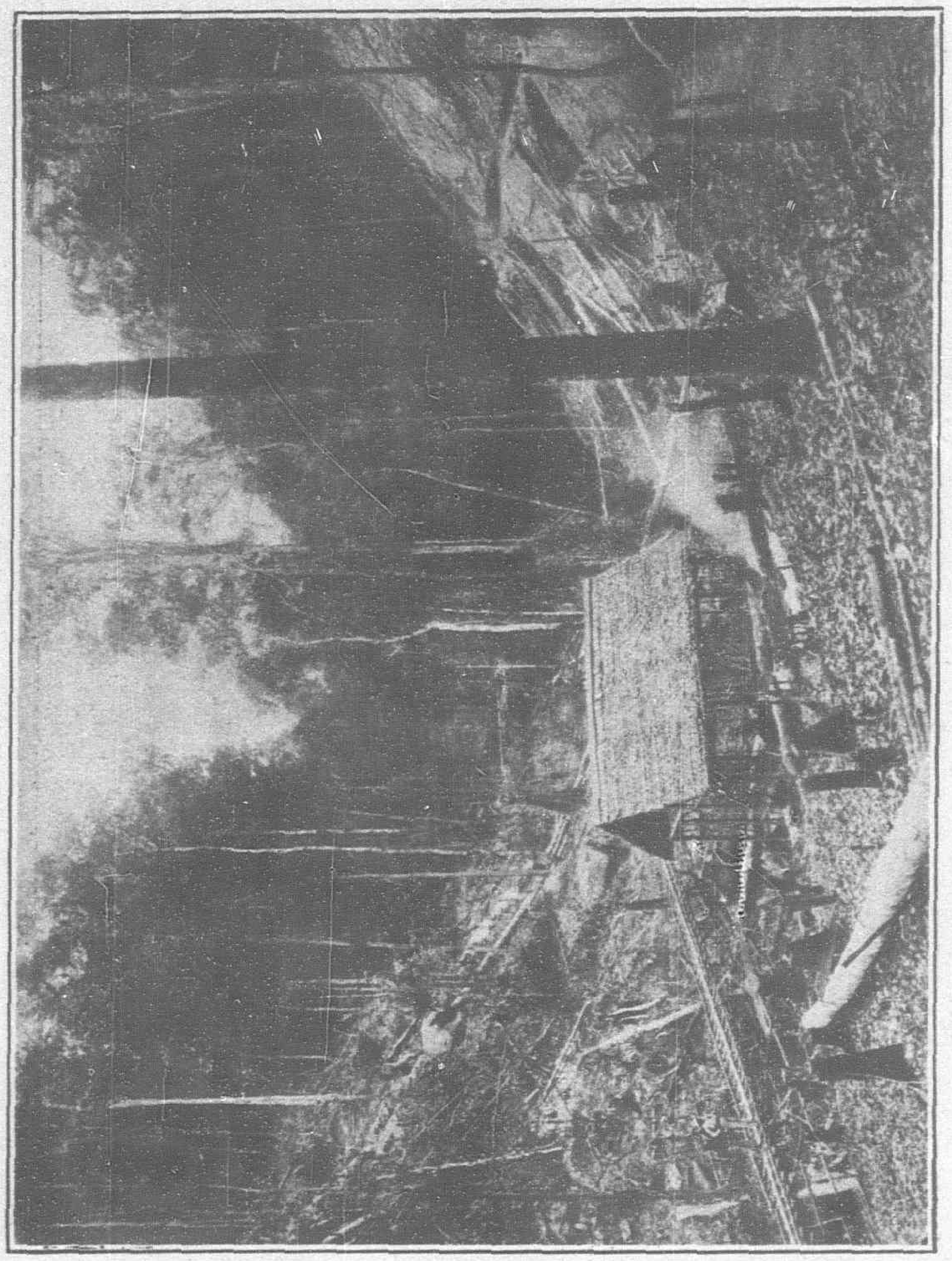
Many of the water courses on the mountain, though small in volume, are extremely beautiful. Speaking generally, they are steep and often flow through rocky gorges with many small waterfalls. In some cases, the valleys are so choked with enormous boulders that the streams are out of sight at a great depth below.

The highest waterfall found is on the Ayer Hitam which flows northwards off the mountain. It is 100 feet high and drops almost sheer down a granite face. At the top of this fall, on the smooth water worn granite, there exists a depression, which legend describes as an imprint of the foot of Buddha.

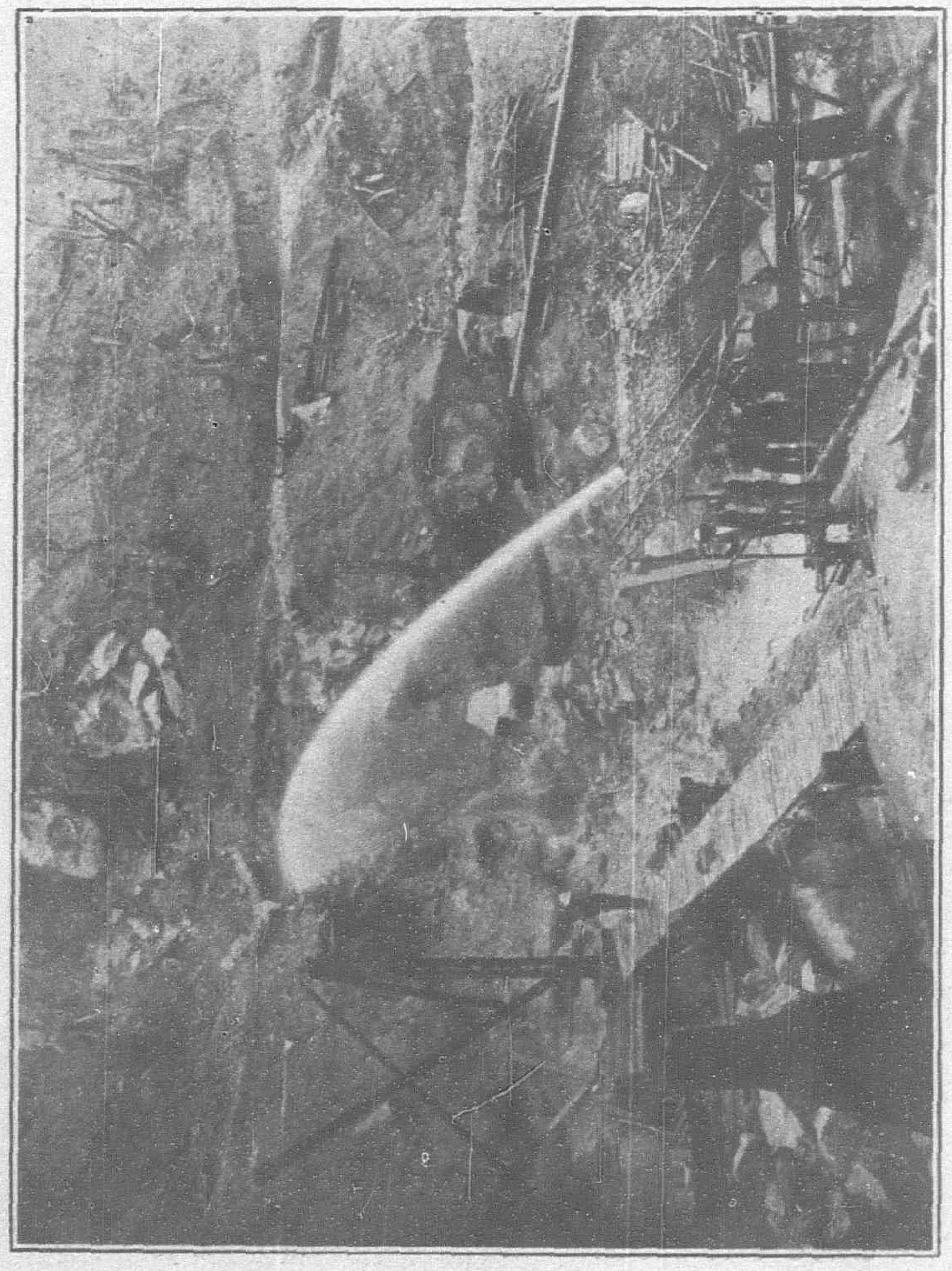
Pelepah Possibilities

Simultaneously with the investigation of the Pulai area, an examination was made of the mountainous district around Gunong Muntahak.

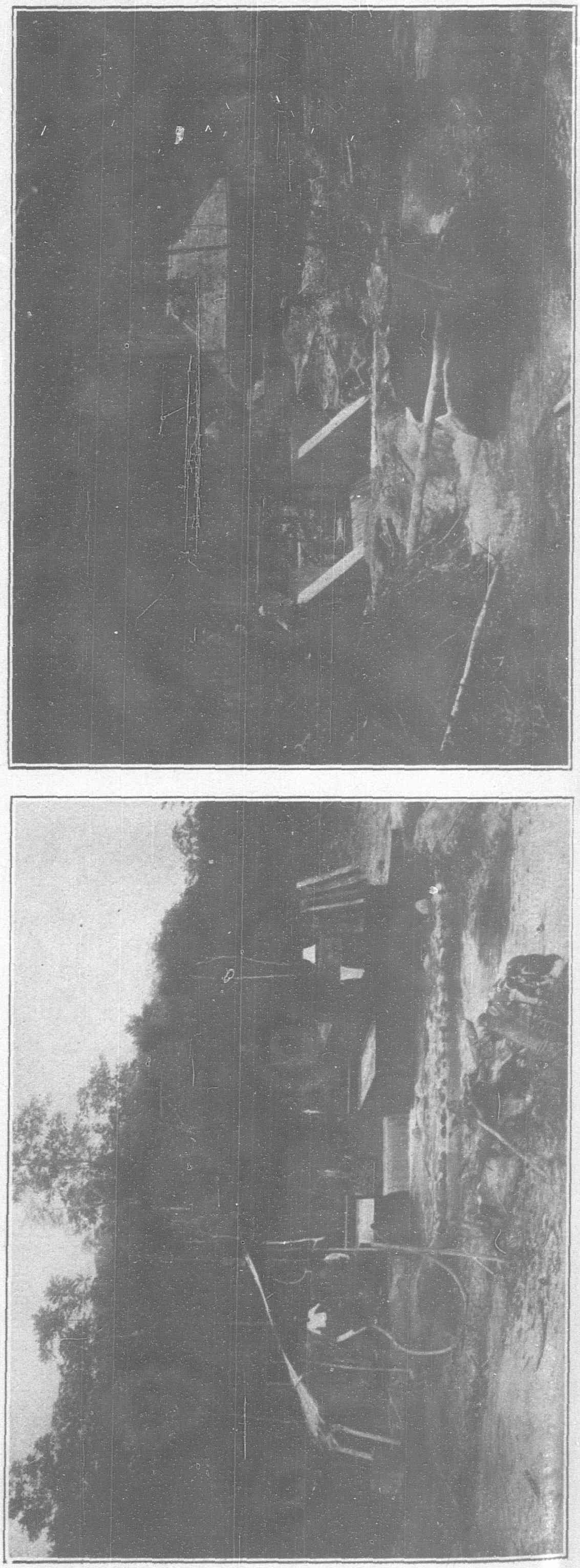
RECONNAISSANCE OF PULAI RIVER TO GAUGE FLOW AND SELECT DAM SITE



Pulai River Showing Site for Concrete Dam

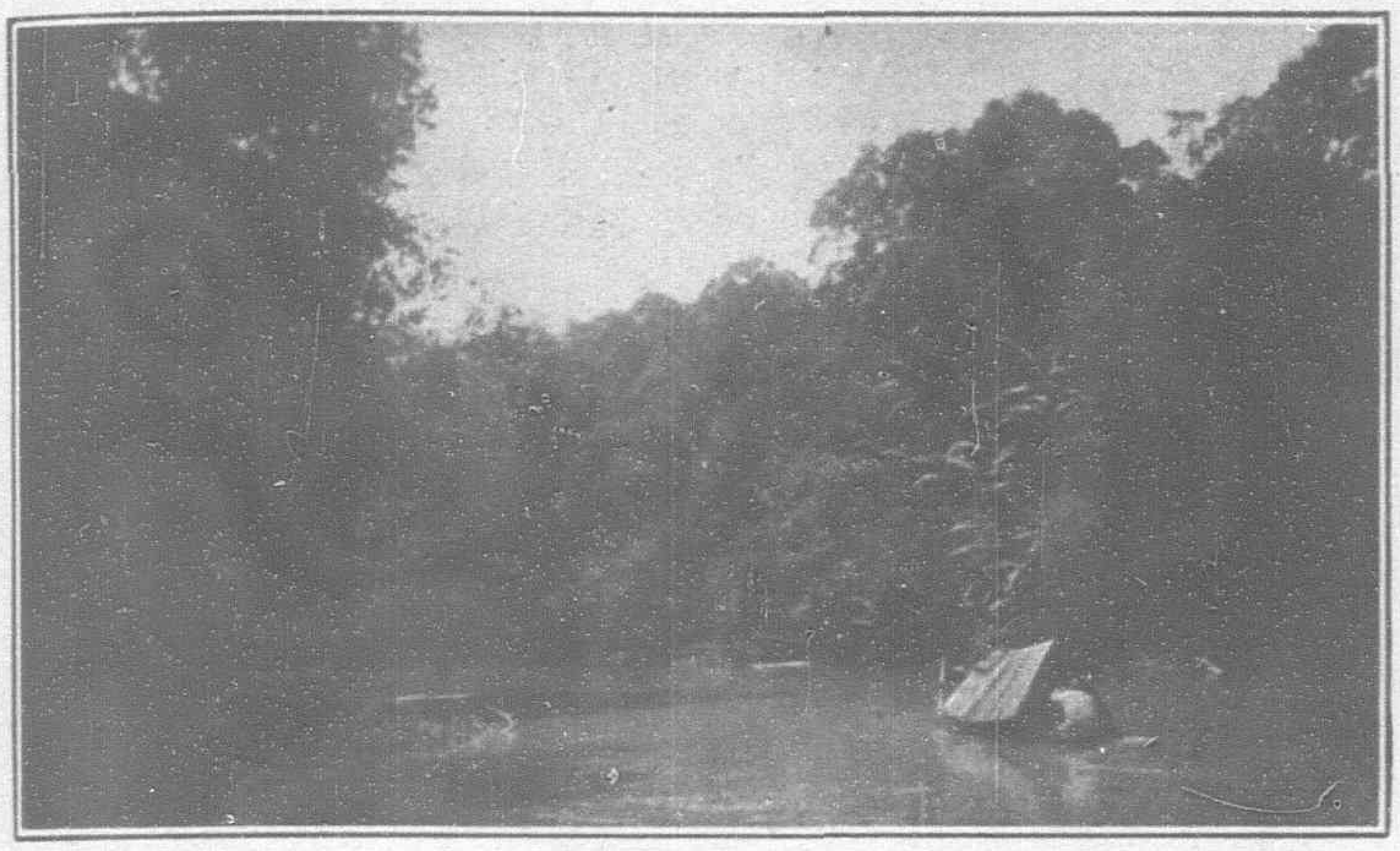


Monitor at work Washing Down to Bedrock



Two Stream Gauges Measuring Flow of Pulai River

The Sedili River, with its tributary, the Mawai, was examined, also the Lebak Valley. A visit was also paid to the Tengkil Valley, where the Tengkil and Middleton Tin Mines are situated. It was thought possible that works for water supply might be constructed in the Tengkil Valley in such a manner that they could be brought into operation about the time when the mining resources of the valley became exhausted. On investigation, however, it proved that the water resources of the valley were insufficient for our needs, and the distance from Singapore was too great.



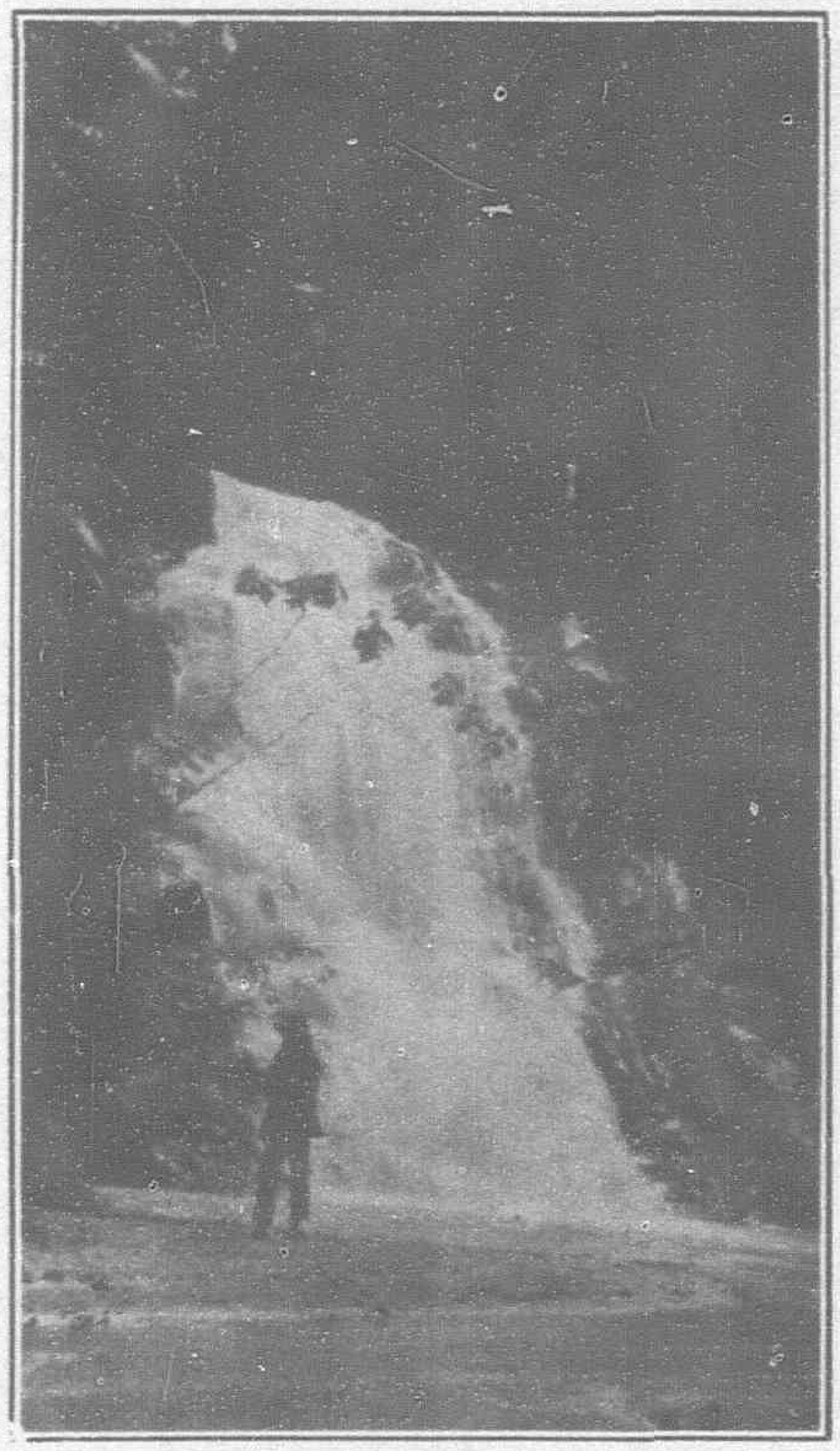
Johore River

Work in the Muntahak district then settled down to an investigation of the Pelepah River, which provided a most fascinating scheme.

It was found that the Pelepah River derived its water from two branches, the Pelepah Kanan and the Pelepah Kiri, both rising on the southern slopes of Gunong Muntahak. These two branches unite near the foot of the mountain, and flow through a basin of great extent, discharging through a gorge, whence the river flows through flat land to join the Johore River.

This area was found to be much easier of access than the Pulai area. It was opened up originally for tin mining by the Royal Johore and its associated companies, and though operations on a large scale have long ceased, a considerable amount of lampanning is still carried on there.

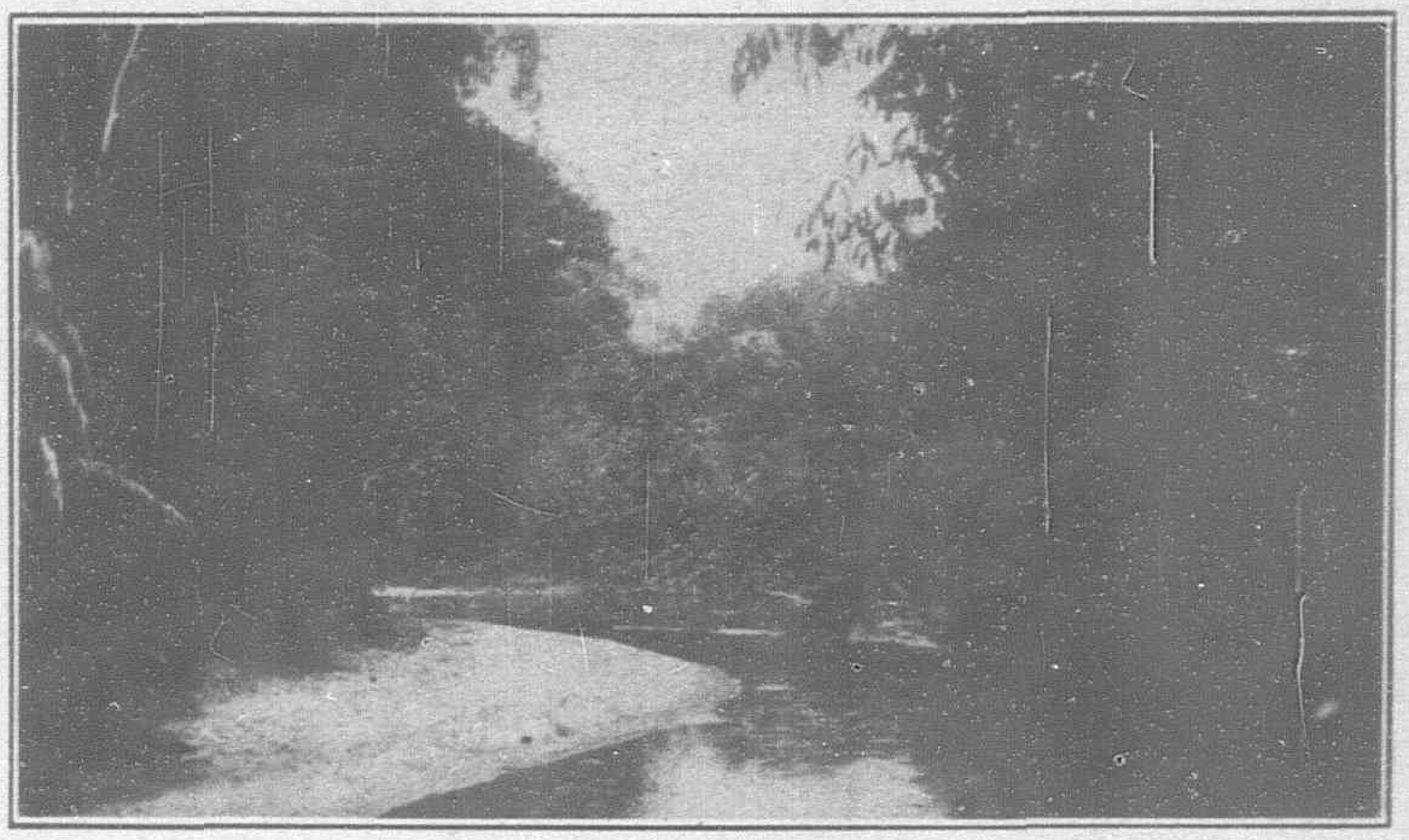
Both Pelepah Kanan and Pelepah Kiri are beautiful streams, and possess at a high elevation valleys suitable for damming; but it was considered that the quantity of water available in these two streams, if taken at the high elevations, would be insufficient to warrant the heavy expenditure which would have been involved, and that a more economical proposition would be to dam the main gorge below, thus flooding the large flat basin and creating a very great storage of water.



Waterfall on Pelepah River

At one period of the investigations, it was thought that this area would provide a scheme superior to that of Pulai, but when worked up it was found that the water supply which could be obtained, though ample in quantity, would have been too costly, as the distance from Singapore was greater and the whole quantity of water would have had to be pumped.

Some old surveys of this area were found in the Johore Survey Office, but they were not sufficient in extent or accuracy for our purposes, and the whole catchment contributing to the Pelepah River was resurveyed by us. A stream gauge and several rain gauges were also established on this area.

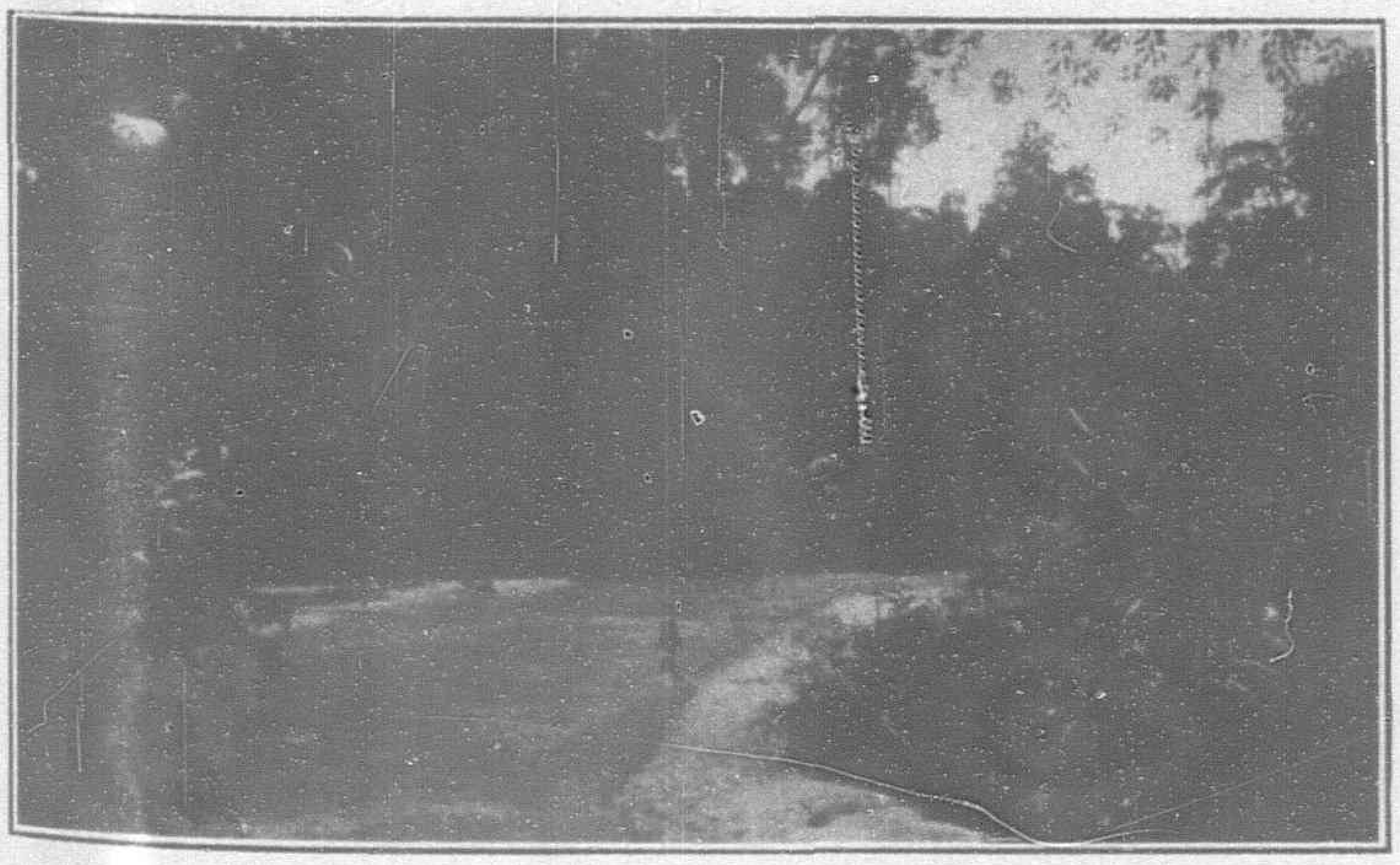


Lenggiu River

The geological formation of this area is quartzite and sandstone, whereas that of the area investigated at Pulai is entirely granite, and it was anticipated that the comparison of the run-offs of these areas would have given valuable information. The early discontinuance of gauge reading in the Pelepah area has, however, made this interesting comparison impossible.

On account of the very large storage anticipated under the Pelepah Scheme, the possibility of utilising a portion of the water for the production of power was considered, but was not found to be practicable.

In connection with this scheme may be mentioned the ascent of Gunong Panti, a hill 1,500 feet in height, having a long flat top. There was a story current among the older native inhabitants of the neighbourhood that a lake existed at the top of this Gunong, from which the Sungei Lalang was fed. That story seemingly originated from the fact that the flat top, which is at a slightly lower elevation than the peak, is of the nature of a long narrow swamp, on which the tree and jungle growths are stunted. The results of the in-



Pelepah River

Sakai Village on Lenggiu River

vestigations in the Pelepah area were placed before the Consulting Engineers at the time of their visit in October, 1922.

At this time, October, 1922, two other schemes were mentioned to the Consulting Engineers, neither of which had then received detailed investigation. One was the Lenggiu Scheme for obtaining, direct from the River Lenggiu without impounding, a river supply to be pumped to Singapore. This scheme was considered worthy of further investigation. The other was the Skudai Scheme for taking the impure water of the Skudai near its estuary, and there establishing purifying works before pumping the water to Singapore. This scheme was considered unfavourable.

Investigate the Lenggiu

At the beginning of 1923, it was decided to investigate the whole of the Lenggiu area. The Sungei Lenggiu and its tributaries take their rise on the Blumut mountain range, distant some 43 miles from Johore Bahru. They drain altogether some 140 square miles of country, and discharge into the Johore River, a little south of Tengkil Tin Mine.

The highest points of the Blumut range are Blumut and Berchuak, twin peaks both over 3,000 feet in height, which dominate that part of Johore. They are entirely covered with dense jungle and their summits are usually enveloped in mist; in fact there exists, upon these peaks, vegetation which will only survive in a continuously moist atmosphere.

It is doubtful whether these peaks had been ascended more than once or twice by Europeans before our visit.

The whole of the Lenggiu drainage area is virgin jungle, broken only by some half dozen small Sakai clearings and one small mining lot (since abandoned).

The rivers are navigable for many miles by small Sakai boats which, in fact, constitute the most convenient mode of transport, being very light and easily lifted over the obstructions and sandbanks with which the rivers abound.

There is a charm about these rivers which leaves an indelible impression on the mind; the utter calm and peacefulness, broken only by the occasional cry of some denizen of the forest, the ever varying scenery, the rich tropical vegetation, the splash of colour here and there, where a mass of orchid or a fruit laden tree breaks the green monotone of the jungle.

Away from the streams all travelling must be done on foot. Elephant tracks are available in places, and there are Sakai tracks, which are however, difficult to find and follow without a guide. For the most part such journeys were done by cutting a way through the jungle.

To aid in obtaining a sound general idea of the country, a clearing was made on the summit of Bukit Chelinting, 1,500 feet high, from which the whole basin of the Lenggiu and its tributaries could be seen, nor will that view soon be forgotten, shewing as it did mile after mile of virgin country, untouched, unoccupied, rising gradually, ridge by ridge to the summit of Gunong Blumut.

The lines which were of importance to our investigation had to be located and surveyed a work of no small magnitude in such country.

It was found that none of the streams contributing to the Lenggiu could be tapped at a sufficient elevation to provide a gravitation supply, but many possibilities existed for utilising the very ample water resources of the district.

These possibilities were worked up and presented in the Lenggiu Report, dated July 17, 1923. They comprised the Lenggiu River Scheme, for taking the dry weather flow of the River Lenggiu; the Jengeli Scheme, for taking the dry weather flow of the Sungel Jengeli, adding to it as a later instalment the upper waters of the Lenggiu; and the Ulu Lenggiu Scheme, for taking the impounded flow of the Ulu Lenggiu, adding to it as a later instalment the flow of the Sungei Senteroh. These were all pumping schemes, and demanded, therefore, the most careful enquiry into pumping costs. In the course of these investigations, the resources of the Sungei Pengeli and Sungei Chenas were also examined, and reported upon.

Fortunately for us, we had, while working in this district, the opportunity of co-operating with the Government Geologist attached to Johore, and the combined topographical and geological information obtained in this area is undoubtedly a valuable addition to the records in the Johore Government Office. The conclusion arrived at, as a result of the Lenggiu investigations, was that the Lenggiu Scheme would be more costly than Pulai, but that it would provide a water supply adequate for an indefinitely long period.

Semangar Valley Considered

There remained still one area to be investigated, namely, the Semangar Valley, this area being much nearer to Johore Bahru than the Lenggiu area. The Semangar River takes its rise near Kulai on the F.M.S. Railway, and flows eastwards to join the Johore River, some 11 miles north of Kota Tinggi. When first examined, the Semangar River did not appear to be a very promising source of supply, but a study of its general location indicated that it must drain a very large valley. Surveys were, therefore, undertaken to ascertain the extent of this valley, which was found to be 50 square miles. It was obvious that the rainfall over an area of so great an extent, collected by impounding, would provide a very ample supply of water, and investigations were therefore continued.

The Semangar valley had formerly been partially opened up for pepper and gambier cultivation, but such cultivation has long since been discontinued, and the abandoned plantations were found to be thickly grown with blukar and resam, which proved even more impenetrable than virgin jungle, and the surveyors working in this area had a very hard task. They were, however, successful in completing their surveys, which included the location of dam sites, the making of trial borings, and the measurement of stream flow and rainfall. In this area also a hill top was cleared, for the purpose of obtaining a comprehensive view over the whole Semangar valley, and ascertaining its relation to the other schemes. Alternative proposals for the development of this area were then worked up, and presented in the Semangar Report dated November 24, 1923.

It was found that this area could be developed at a less cost than the Pulai area, and that its water when delivered in Singapore would ultimately be no more costly than Pulai water. Moreover, the supply available was very much greater than the ultimate supply from Pulai. It was, however, entirely a pumping scheme, and no part of its water could be delivered by gravitation. It also involved the construction of an impounding reservoir with a very large water spread. These conflicting considerations gave room for wide differences of opinion as to the relative merits of the two schemes. In connection with the Semangar investigations, the valley of the Tebrau was also examined, and its possibilities as a source of water supply were reported upon.

Consulting Engineers' Final Recommendation

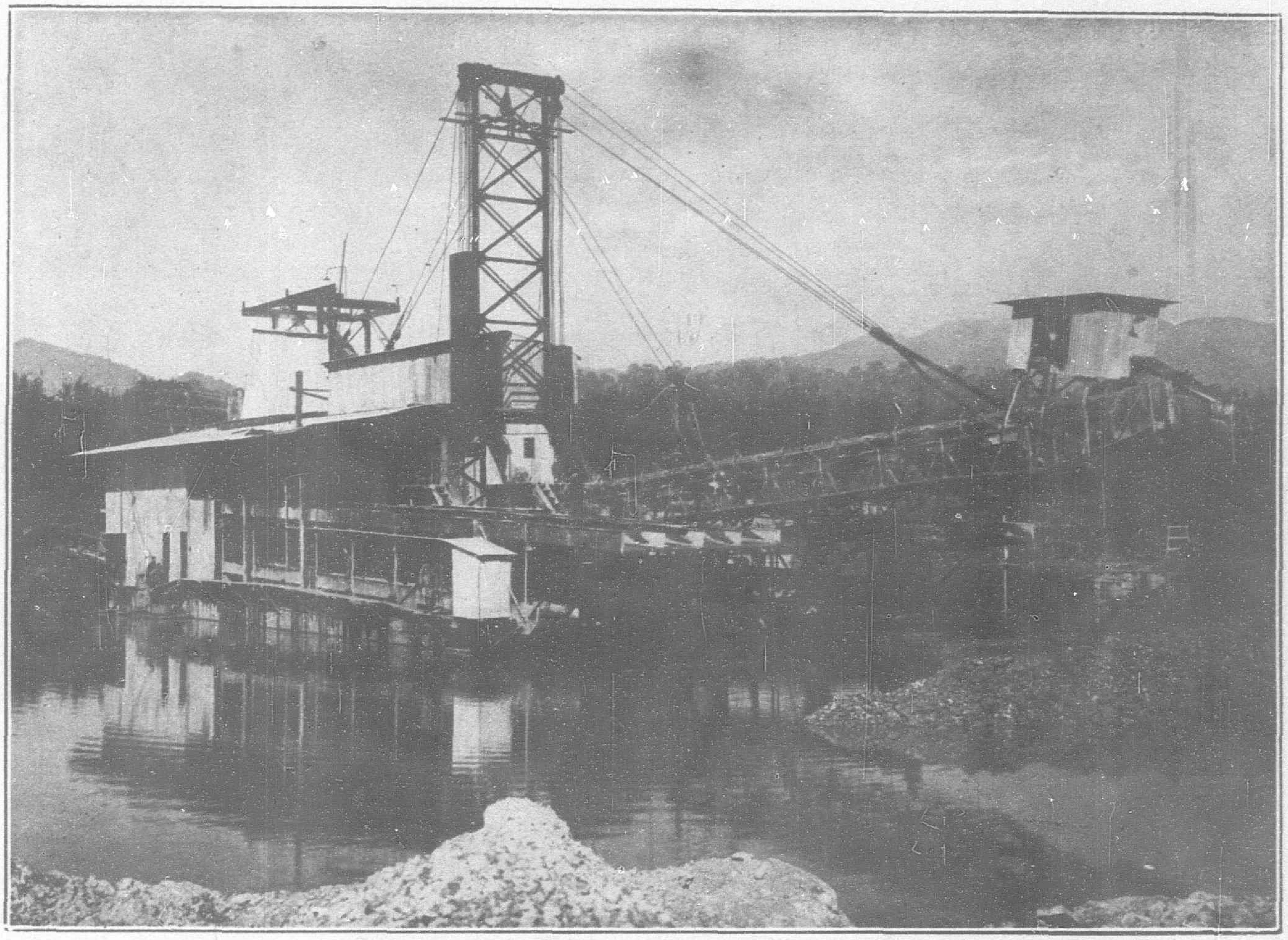
The Lenggiu and Semangar Reports were placed before the Consulting Engineers on their second visit in December, 1923. They visited Semangar and, while recognising the lower capital cost of that scheme, they considered that Pulai presented certain practical advantages (based chiefly upon its large high-level storage) sufficient to warrant its adoption in preference to any other scheme. They therefore, confirmed their formed recommendation that the Pulai Scheme should be adopted, and their recommendation was accepted by the Commissioners at a meeting on December 13, 1923.

Consideration had also to be given to the question of conduits for conveying the water from each selected source to Singapore. In this connection, pipelines were located across country, with due regard to questions of gradient for the transport of materials and men, and depots for the handling of materials during construction. On none of the routes had actual survey work been formerly carried out, and it was necessary to run many miles of survey lines and levels along the selected routes.

General Considerations

In connection with the investigation of the various sources of water supply, many samples of water were collected and submitted to analytical and bacteriological examinations. Enquiry was also made as to the health conditions in each district, the prevalence of fever, and the probable extent of the anti-malarial work which would be necessary if construction works were undertaken.

In the course of these investigations, reference was made to all sources of information in the Peninsula that could possibly have any bearing on our enquiry. Much useful information was obtained from the Government Hydraulic Department in Kuala Lumpur, on the subject of river discharges in relation to various geological formations; also from many mine and estate managers, who had kept stream and rain gaugings. Reference was also made to the railway department in cases where their survey work was adjacent to our own. An investigation of this magnitude embraces a wide range of subjects, and entails an immense amount of hard work on the part of both the outdoor and office staff, to whom, therefore, my thanks and the thanks of the community are due, and it is hoped that the results of their labors will be found not unworthy of the importance of the subject.



Tin Dredging in the F.M.S. Bucket Dredge on the Rawang Tin Mining Properties, at Rawang, Selangor

Tin Mining in the F.M.S.* —I.

Principal Mines and Occurrences of Tin Ore in South Perak

By J. B. Scrivenor, Geologist, F.M.S. Government

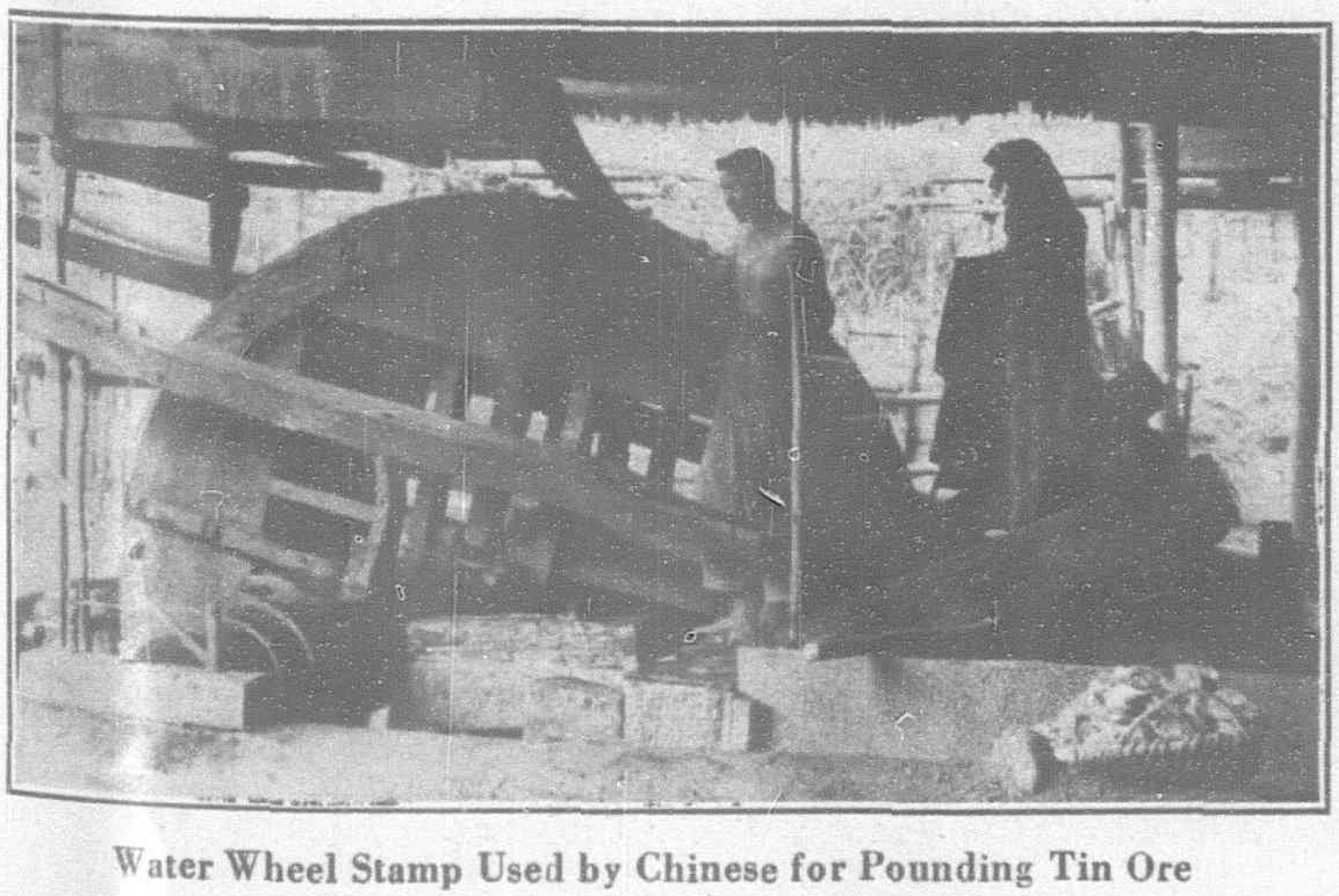
Ampang

IN the Ampang tin-field, south of Tambun, there is not much to note. On the Ampang Tin Mining Co.'s property the bed-rock is partly dolomite and contains tin-ore *in situ* in small quantities. Some of the detrital ore about it is doubtless derived from this source.

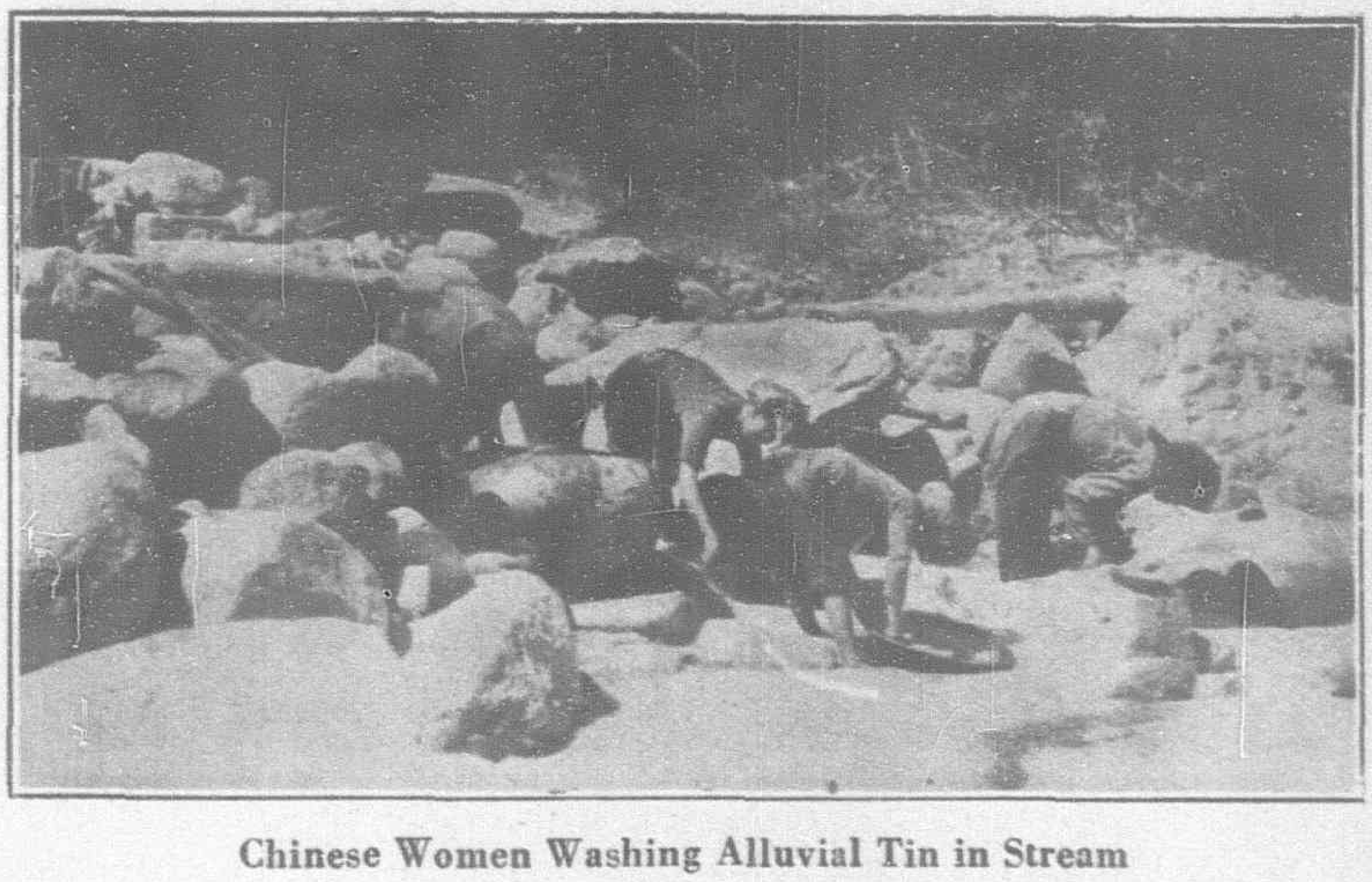
Ampang is one of the few localities where corundum-boulders occur. They are not common. Towards Tambun weathered phyllites occur on high ground.

Bruseh

Bruseh is now a well-known locality on account of the operations of the Bruseh Hydraulic Tin Mines Co. Originally it was intended to work *tanah padi* only by means of monitors, but later it was found that the underlying rocks contained a *stockwerk* of tin-bearing veins, and although these were *in situ,* weathering had so affected the rocks that it was possible to cut the ground with the



Water Wheel Stamp Used by Chinese for Pounding Tin Ore



Chinese Women Washing Alluvial Tin in Stream

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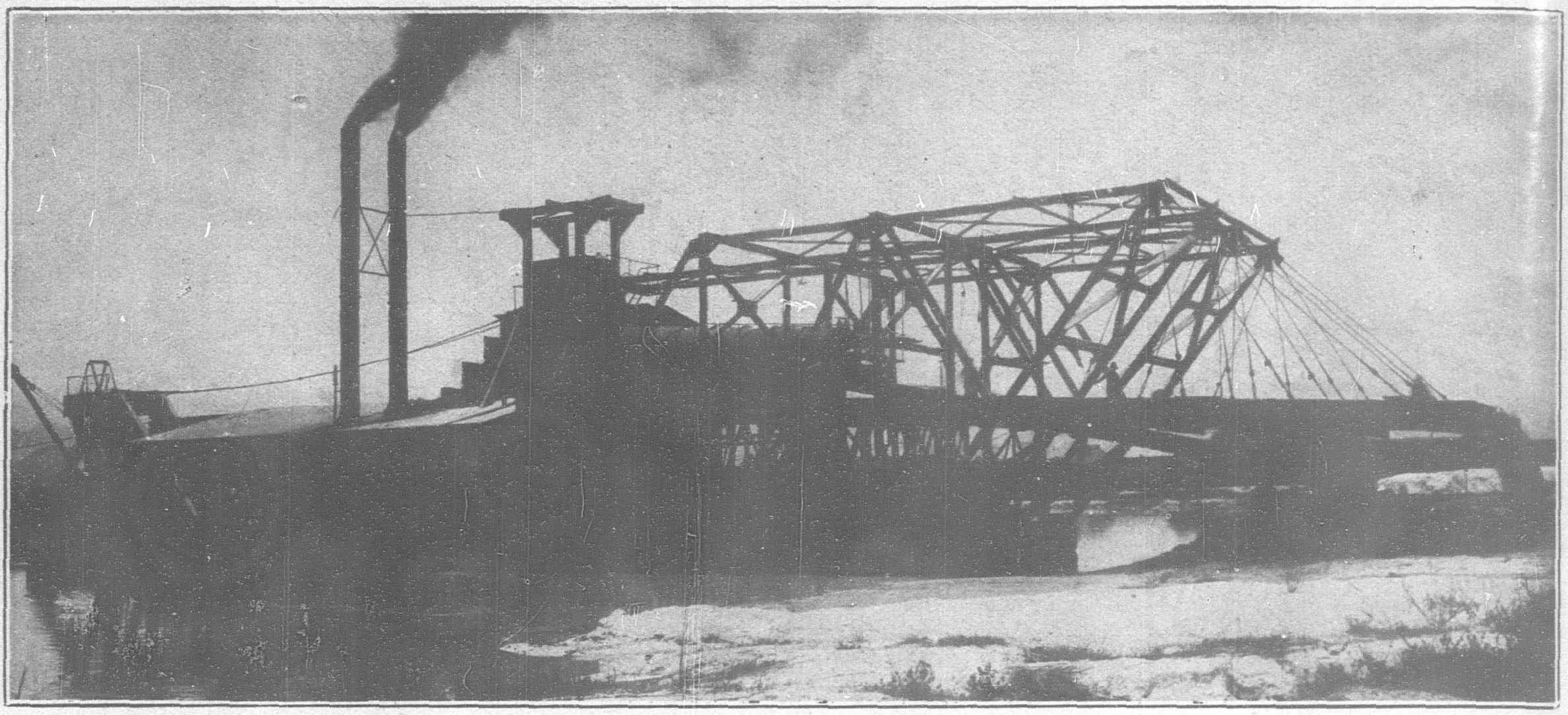
* From the Report of the Geological Department, F.M.S. Government.



Tin Dredge at Batu Gajah, F.M.S.

monitors and concentrate the tin-ore, as though detrital deposits were being dealt with.

On the east of the property is the granite of the main range, bordered by pegmatite and aplite rich in kaolin and sometimes carrying tin-ore. Schorl-rock also occurs, generally as intrusive veins into the older rocks. These latter, which are on the west of the granite, are sandy schists and clayey schists. The former abut on the granite and extend westwards for about 16 chains, dipping to the W.S.W., that is, under the clayey schists. It is difficult to determine what the clayey rocks were before they were weathered. At one spot the monitors reached fresh garnet-pyroxene-schist which indicates that they may have been complex in composition. The sandy schists are clearly altered sandstone. They have as a rule yielded more tin-ore than the other rocks, but it has often happened that a fresh face has had to be left a month or more to weather before the monitors could make any useful impression on it, working at 140-lb. pressure with a 3-in. nozzle.

Masses of ironstone (" laterite "), formed in the most weathered portions of the sedimentary rocks, give much trouble in the work. They are stacked and used as road-metal.

The tin-bearing veins, which are fissure-veins, are numerous and generally rich in tourmaline. This mineral extends for some inches from the fissure, the latter being in some rare cases almost completely filled with cassiterite over a portion of its length. An exceptional specimen showed a vein of cassiterite two inches thick and smaller veins of the same mineral branching off into the schists. The veins vary in thickness considerably, but an inch may be taken as a fair average. Generally speaking, they are parallel to each other, but it is not uncommon for one vein to split up into two or more smaller veins, and one section, which is, I believe, still standing, shows veins intersecting at an acute angle. Another system of veins, rich in quartz, but also carrying cassiterite, cuts the tourmaline-cassiterite veins.

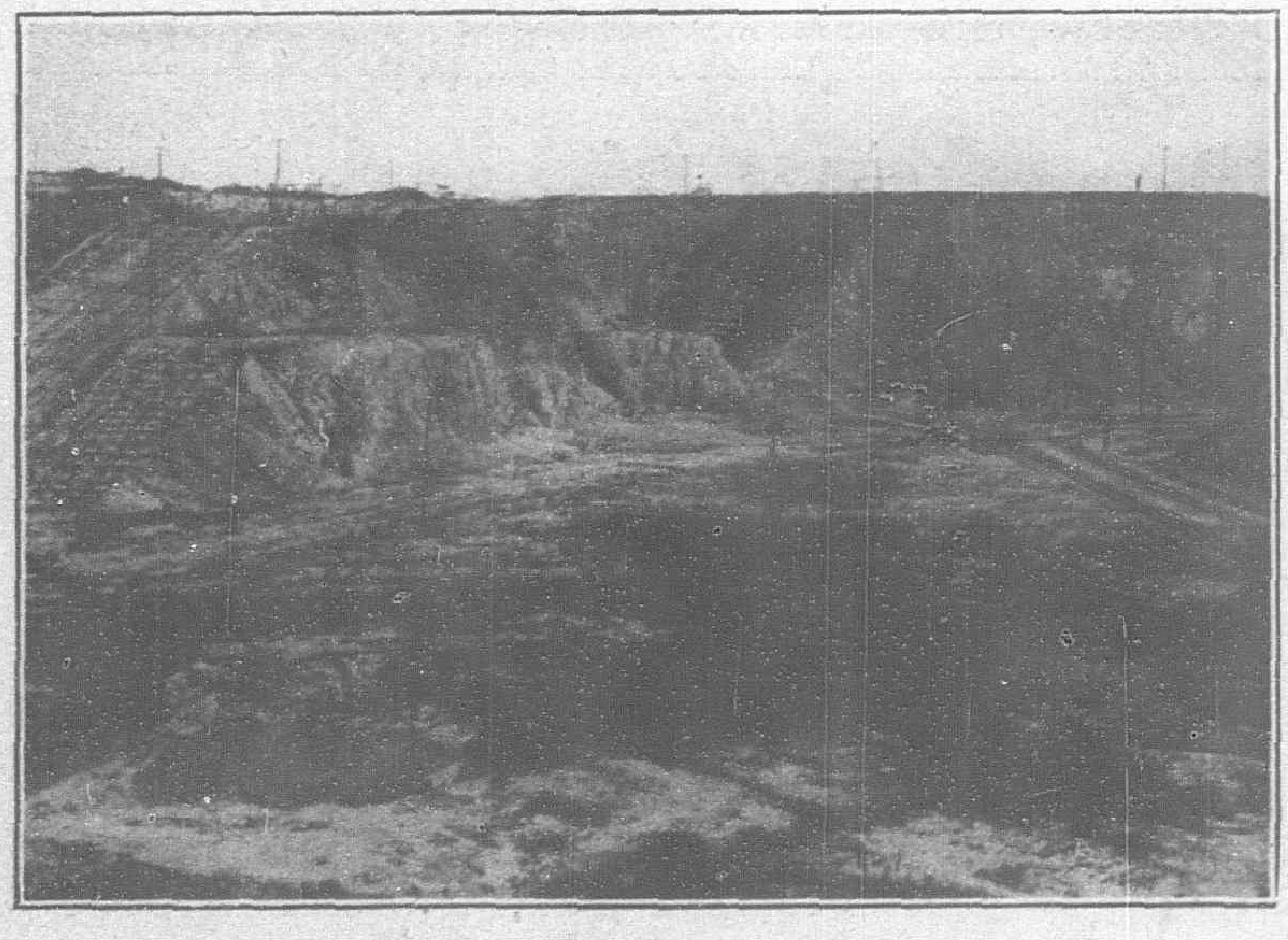
The work at Bruseh now is much reduced compared to what it was prior to 1910, owing to the practical limit of work having been reached in the old workings, although the veins are still visible. An extension of the *stockwerk*, however, has been found to the north.

The average yield of the ground at Bruseh used to be estimated at ½ kati per cubic yard. A little wolfram occurs in the veins.

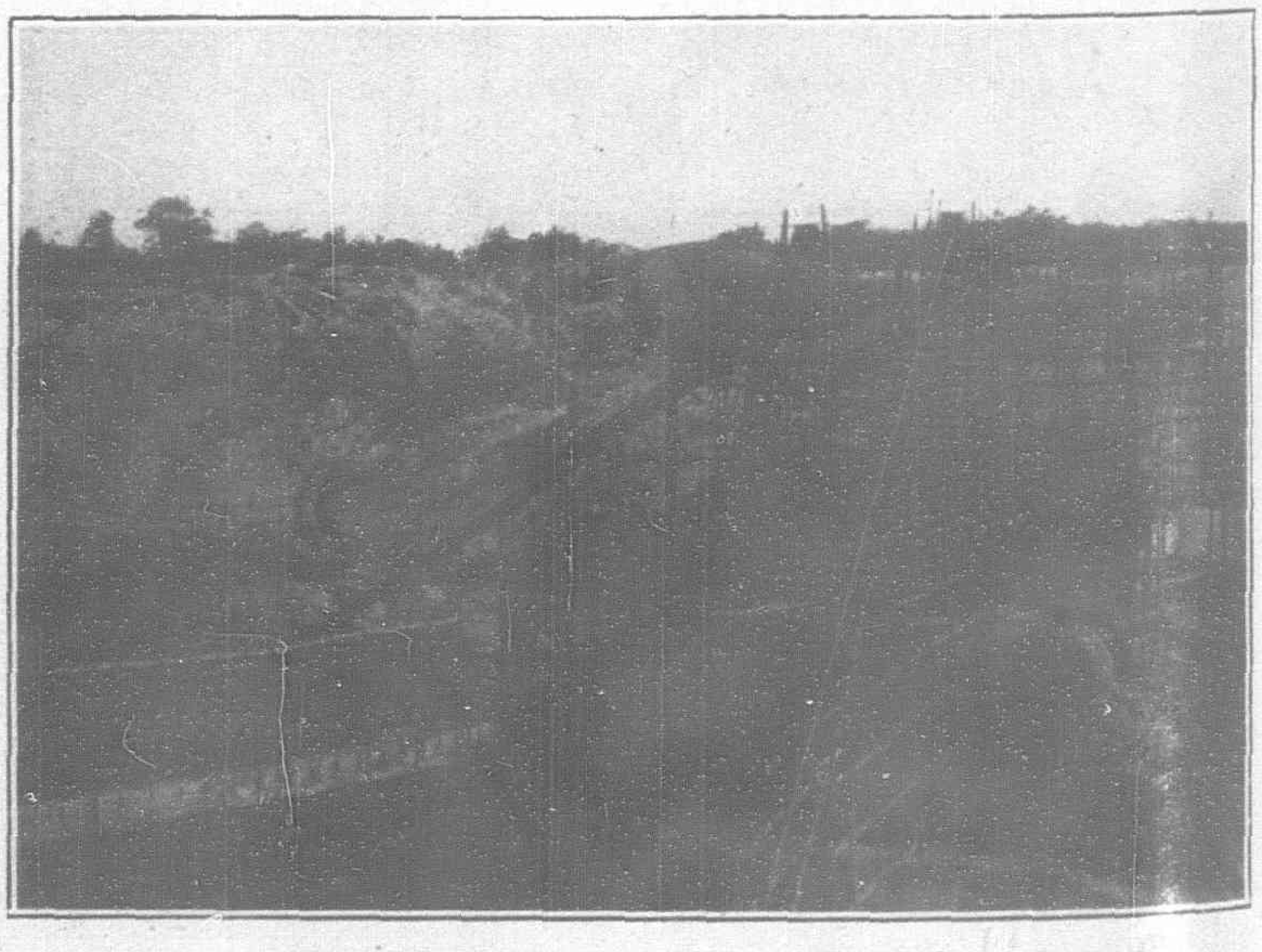
The Bruseh hydraulic property is an excellent example of a big *stockwerk* of tin-bearing veins in altered sedimentary rocks, and it also shows better than any other occurrence of tin-ore in the country to what a great extent the miner has been helped here by tropical weathering. Had the *stockwerk* been situated in a temperate climate very little ore could have been won from it profitably, once the soil had been passed.

Jeher

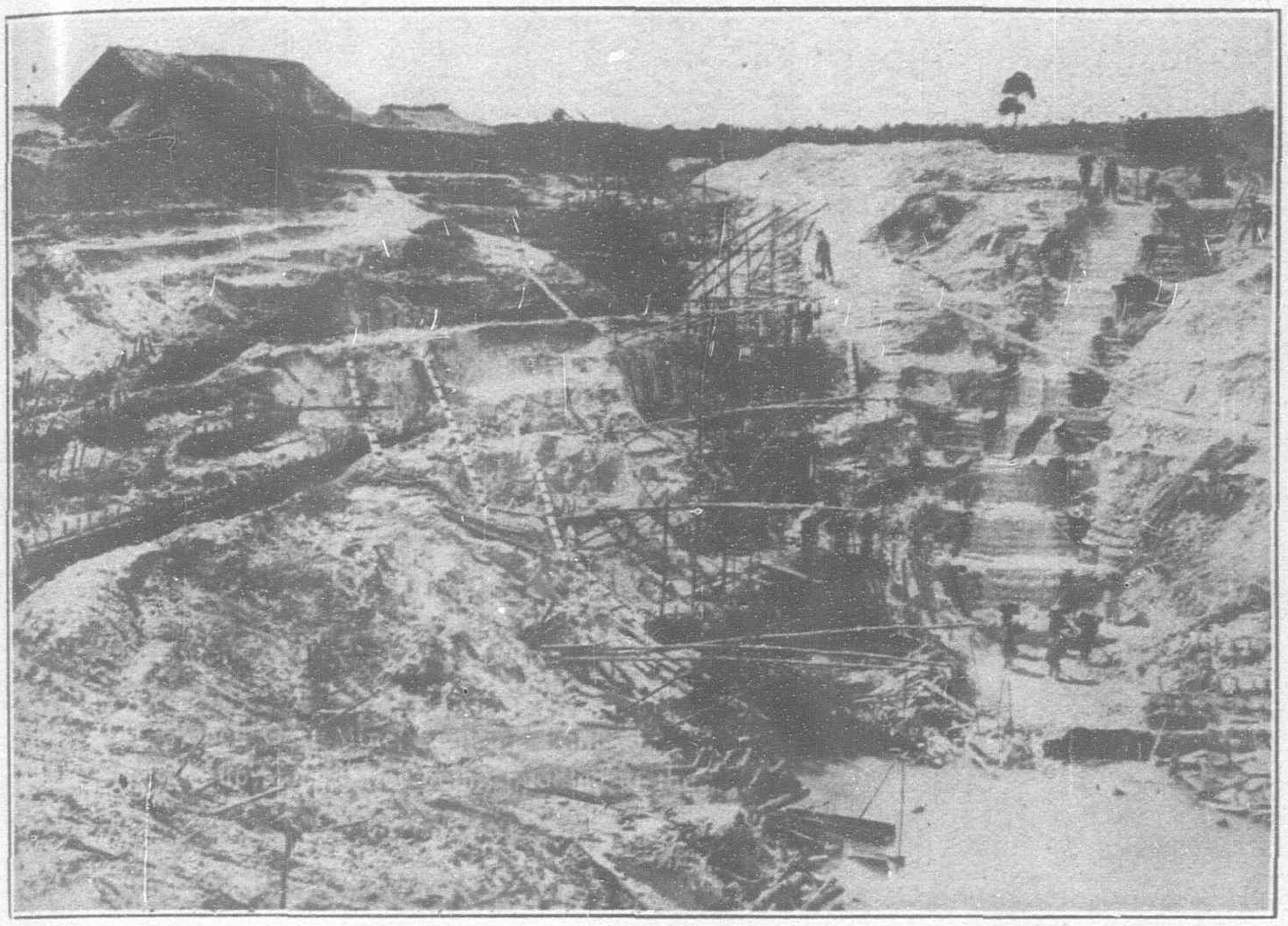
The mine worked near Tanjong Malim by the Jeher Hydraulic Tin Mining Co. is one of those in which operations have decreased in



Open-cast Tin Mine, Selangor



Open-cast Tin Mine at Tanjong Toa Allang



Open-cast Mine, showing Chinese Women Lift Pay Dirt by Bailing it up Steps after being Puddled at the Bottom

importance of late years. About 1907 the mine was at its best. The operations resembled in some respects those at Bruseh. It was known that Chinese had obtained quantities of tin-ore by shallow shafting above a certain line over the back of a low hill. Further examination proved that these shafts had been sunk along a band of soft sandstone and shale country traversed by numerous veins of quartz carrying coarse cassiterite. Monitors were employed and with the aid of blasting it was found possible to work down on the veins in an open-cut to about 40 feet below the surface of the bed-rock.

The band of country along which the veins occurred trended roughly east and west and the mass of veins was inclined from the perpendicular slightly to the south. The greatest thickness of the band was about 20 feet; its length about 1,000 feet.

In addition to the quartz-veins, other veins traversed the country-rock, such as veins of quartz, tourmaline, and muscovite, veins of mica, some being lepidolite, stringers of white mica with cassiterite and sometimes pyrite, and also veins of quartz and kaolin with long prisms of tourmaline.

A large amount of tin-bearing soil was worked on this hill.

Beyond Jeher, Mr. J. Tait has for a long time worked a mine close to the granite-junction. The country rock is sandstone and shale, the former being weathered quartzite. Soft kaolin-veins traverse these bedded-rocks and there is no doubt that they are the source of some of the tin won there. These kaolin-veins resemble those at Gĕlugor, Kĕrling in Sĕlangor, and those in Kinta.

Gopeng

Gopeng, together with Tekka and Jĕluntoh, can be regarded as a small tin-field by itself. It has been very prosperous for many years, and is of such interest geologically, that an adequate description of it requires more space than can be afforded here.

The Gopeng tin-field is divided into four parts. On the east is the stanniferous granite of the main range. To the west of the granite and in the centre of the tin-field is a stretch of high rolling ground trending westwards. To the north of this is the low-lying land of Tekka and Sungai Raia, and to the south the low-lying land drained by the Jĕluntoh and Kampar Rivers.

In the granite area a large island of phyllites and quartzites has been discovered and found to be impregnated with tin. The granite is in places traversed by numerous small veins carrying tin-ore that are worked by means of monitors.

The rolling ground in the centre of the field is higher nearer the granite than further west; and here we have exposed, in the Ulu Gopeng Mine, phyllites and quartzites impregnated with tin-ore from the granite.

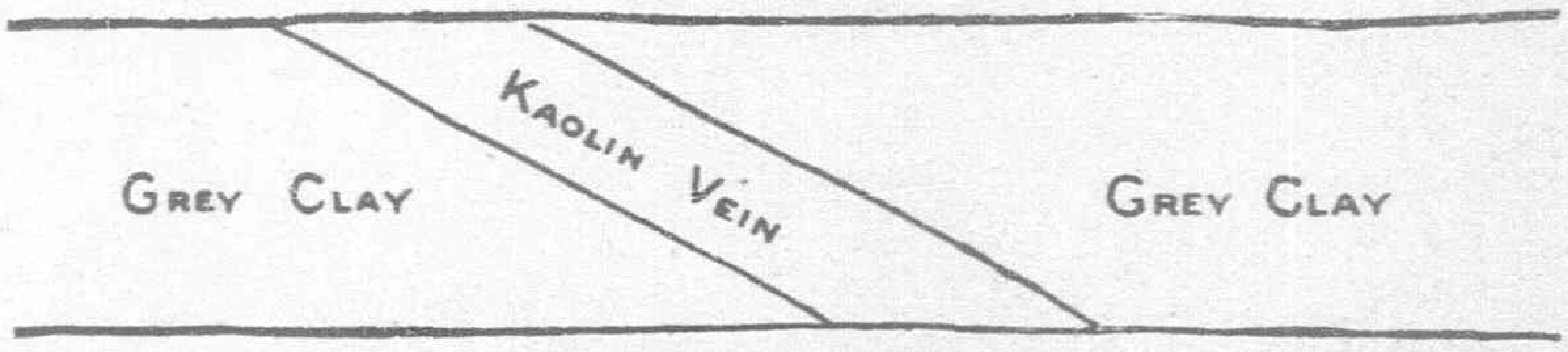
Going westward, and at the same time descending, the phyllites and quartzites give place to the clays and boulder-clays, on which are the big hydraulic mines belonging to Kinta Tin Mines, Ltd., and the Gopeng Consolidated Mines.

To the north the Tekka River has cut down into the clays and boulder-clays so that the low ground is composed of a comparatively thin cap of the clays above the limestone bed-rock. As one approaches Sungai Raia more hilly ground is encountered, formed of the clays and boulder-clays, worked by the Tekka Company and formerly by the Sungai Raia Tin Mining Company.

To the south a thin covering of clays is found over the limestone as on the north, but while on the north the clays abut on the granite, on the south there is a low range of tourmalinized sedimentary rocks between the outcrops of the clays and of the granite.

The most interesting ground in this neighborhood is that on which the big hydraulic operations are carried on. The extent of the sections in the clays and boulder-clays laid bare by the monitors would hardly be credited by those who have not had the good fortune to see them, while the effect of the powerful jets of water, that carry away all loose material, is to reveal with remarkable clearness the minute details of the detrital rocks, the veins from the granite, and the junction between the granite and the detrital rocks.

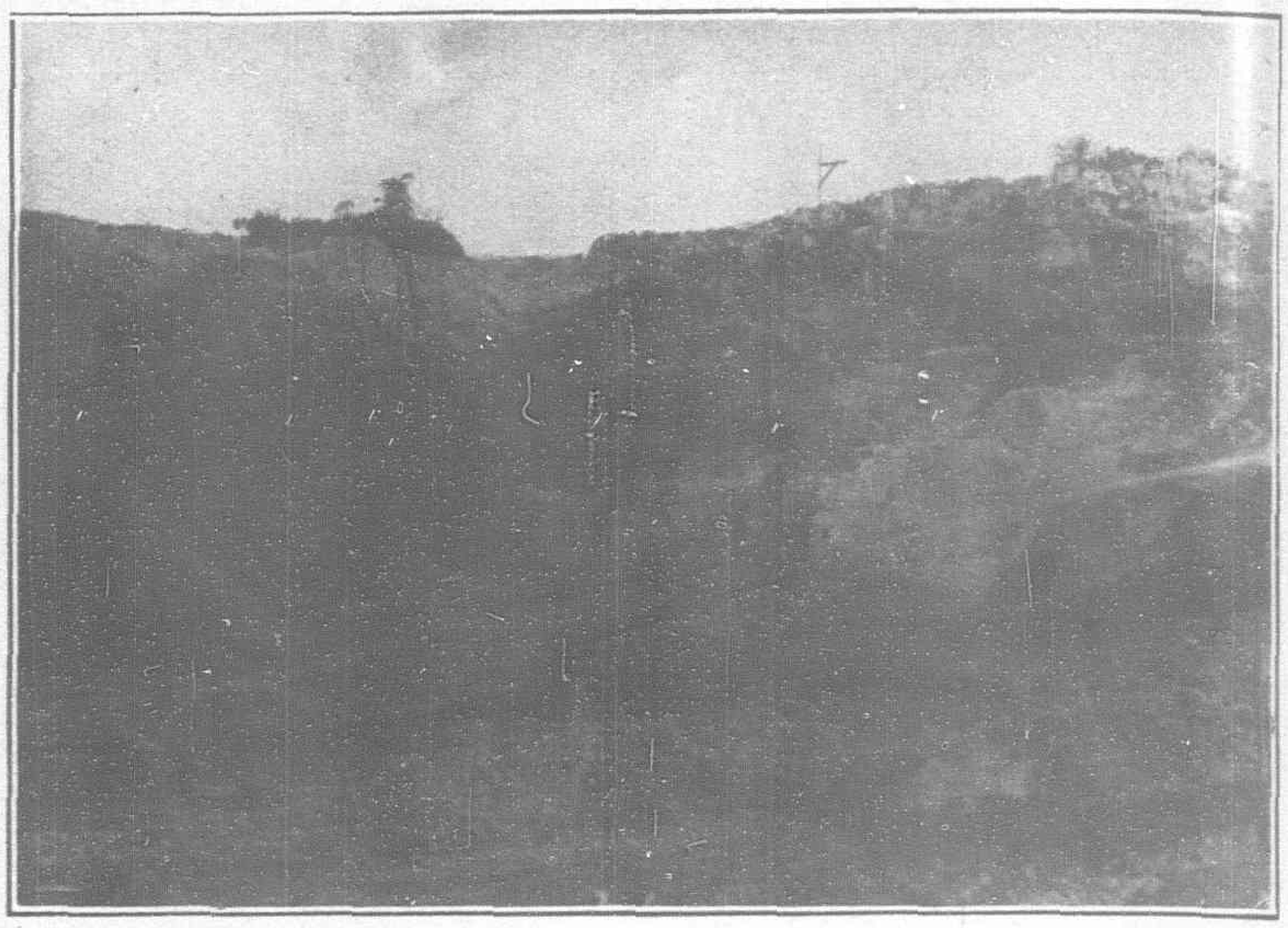
Fig. 14



Section on Gopeng Consolidated Showing Relation of a Kaolin Vein with Lepidolite to the Grey Clay, June 1915

Fig. 14 is a sketch of a section of the Gopeng Consolidated land of a kaolin-vein cutting grey clay. Fig. 15 shows a band of rock composed of blue tourmaline and white mica bordering the kaolin-

Chinese Method of Smelting Tin Ore



Hydraulic Monitors at Work

vein where it is in contact with clay. This section was seen in a deep working close to and north of the Kota Baharu road.

The junction between the clays and the granite has been well exposed on the Tekka, Ltd., property and on a Chinese mine further to the south for a number of years. On the French mine at Tekka-Sungai Raia, a good section showing the junction has been described in the *Geological Magazine* (1914, pp. 310-311). In the workings of the Gopeng Consolidated Company and the Kinta Tin Mines Company the kaolin-veins, limestone, clays, and boulder-clays are well exposed, and the new water-power supplied to these mines will give more information by laying bare sections deeper and at a quicker rate than was possible with the old installation.

Fig. 17 is a plan of part of the Tekka, Ltd., mine where the junction of clays and granite has been exposed for some months. When the sketch was made a monitor was situated near D, and the water flowed away from the face by a ditch indicated by the line A-E. This ditch was joined by another, between B and C. The line C marks part of the contact between clay and granite. In the

Fig. 15.

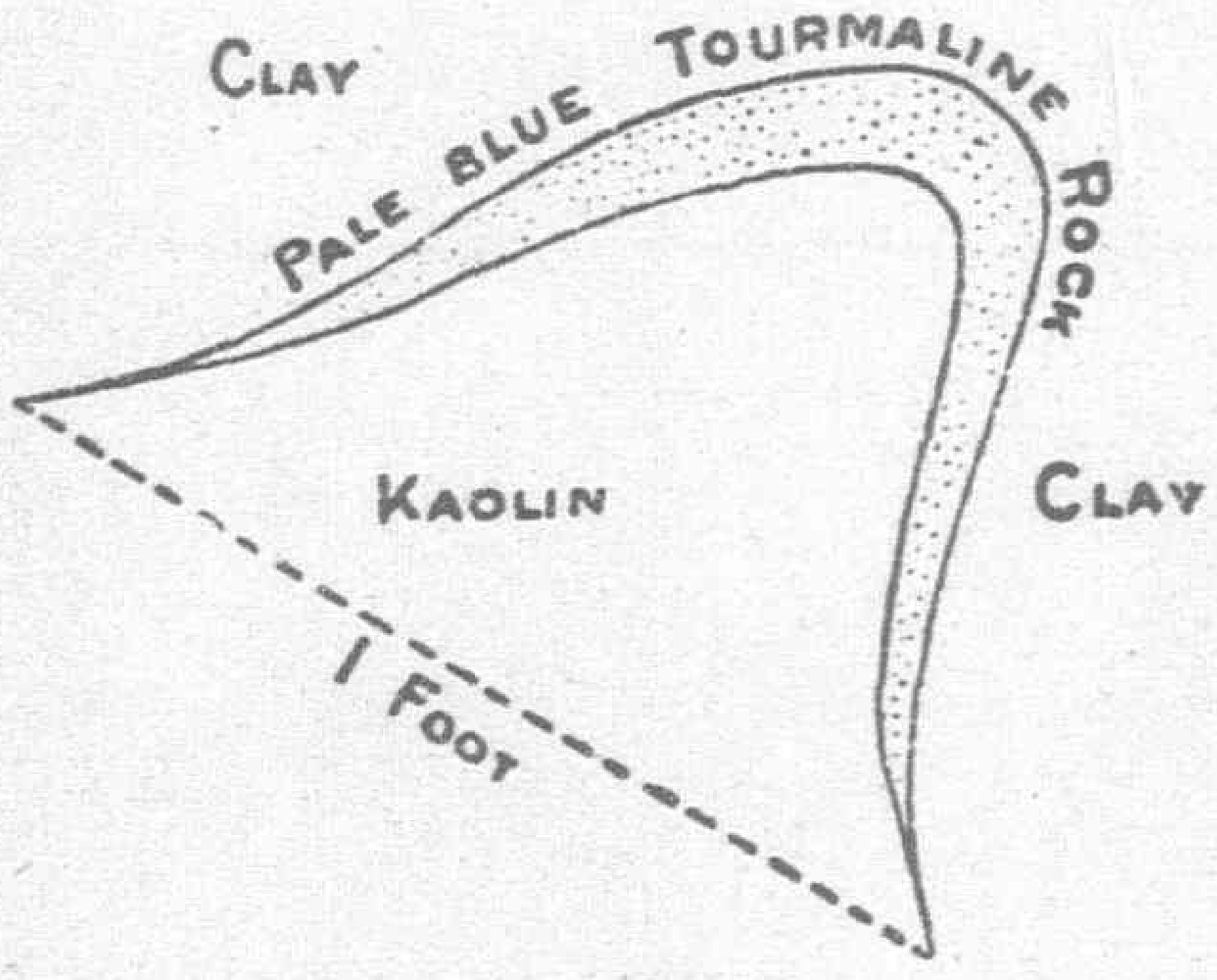
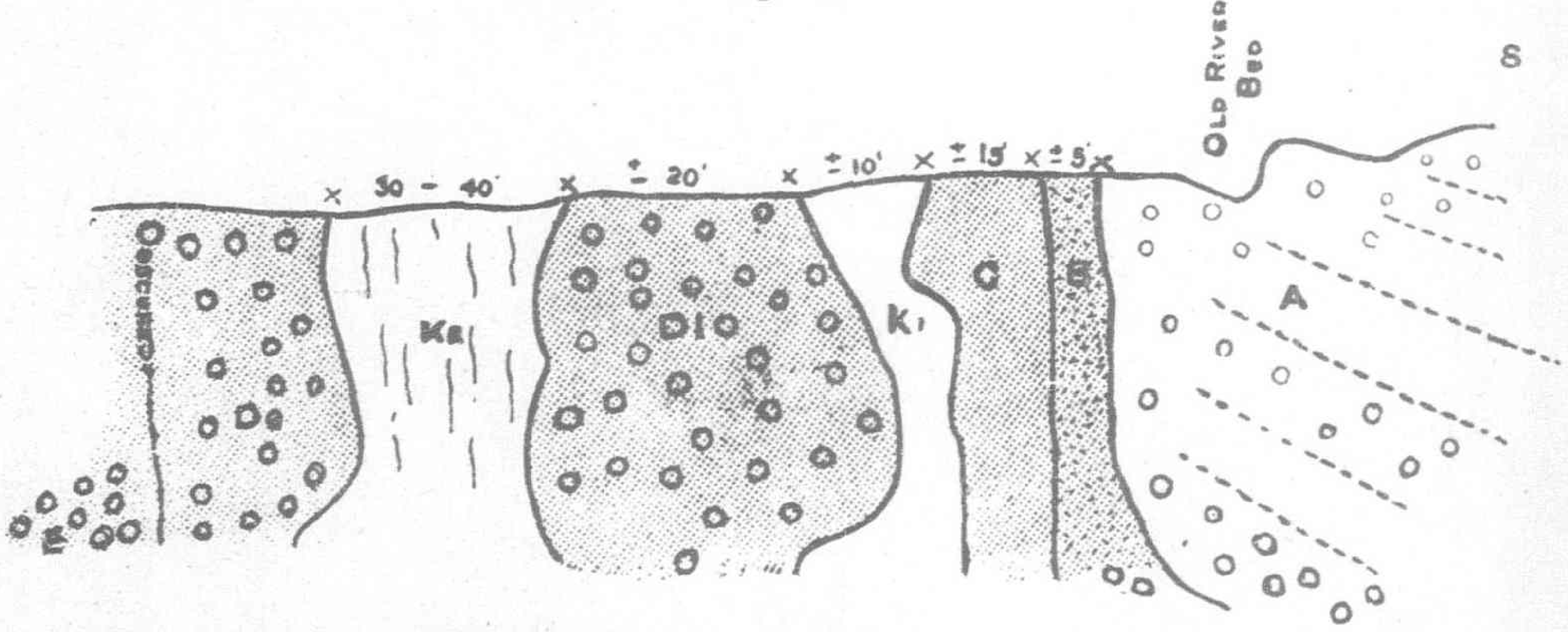
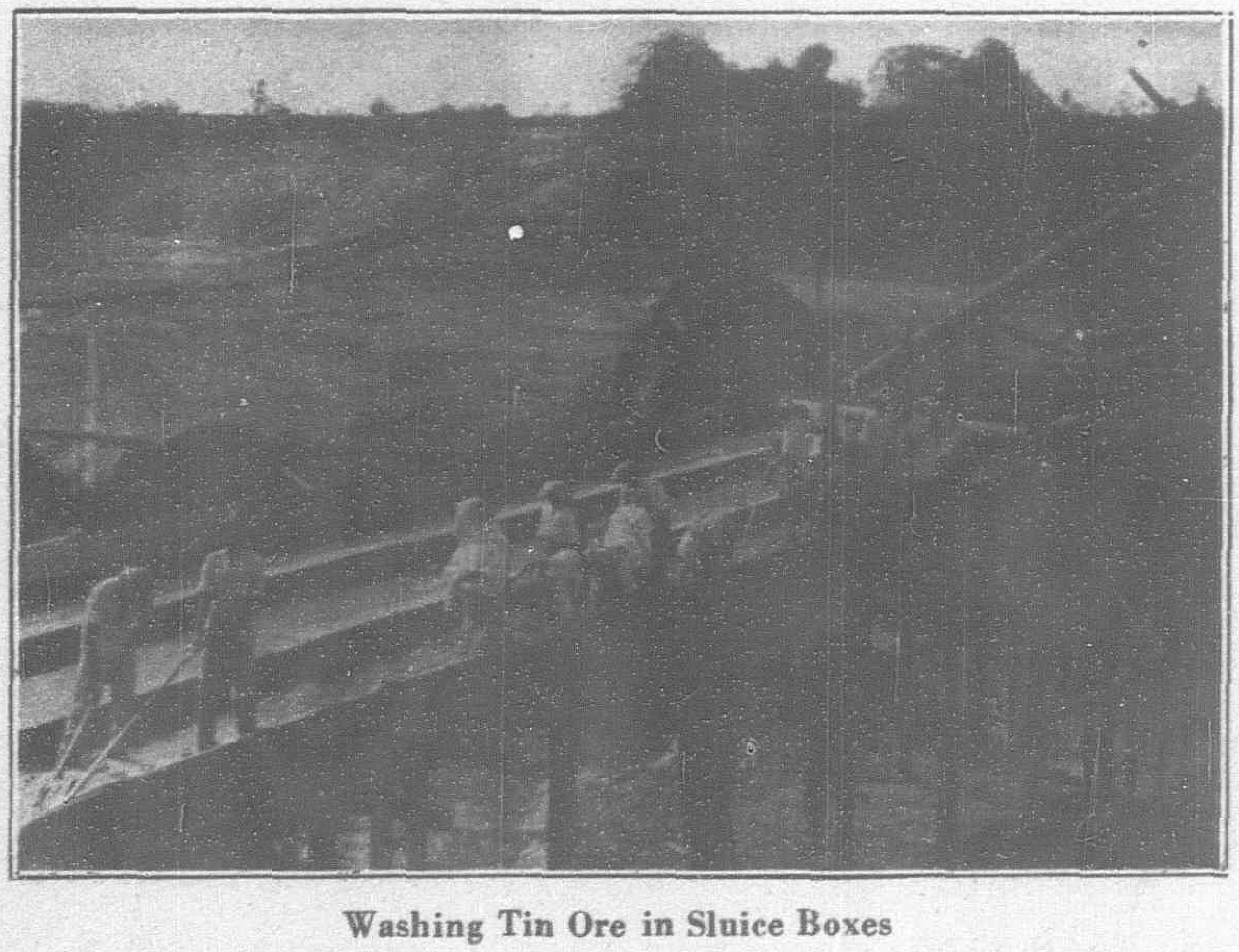


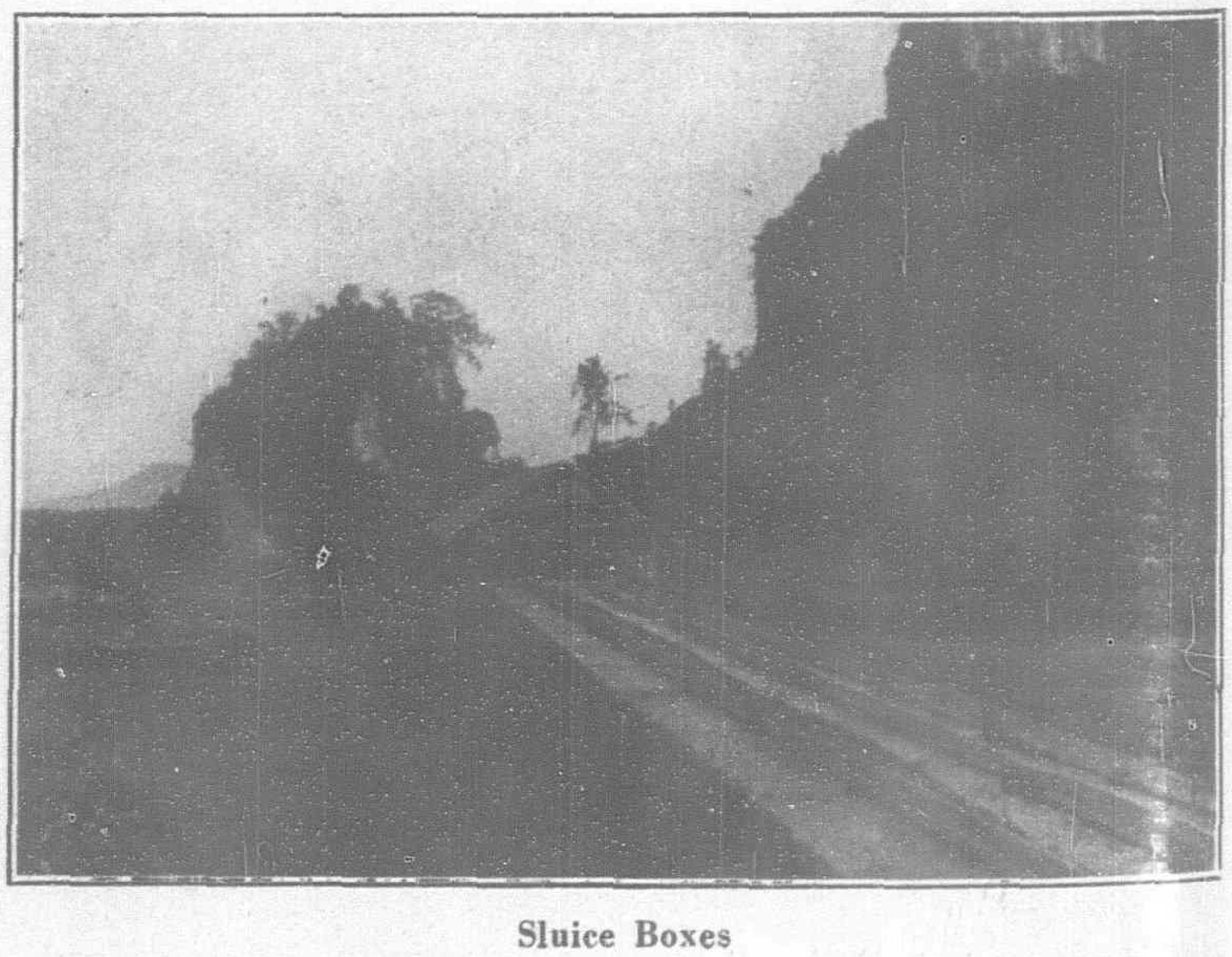
Fig. 16.



A=White clay with boulders and bands of hard white clay without boulders
B=Red and white mottled clay. Transitionary from A to C C=Red clay without boulders
D 1 & 2=Red clay with boulders E=Yellowish-red clay with boulders
K=White kaolin K2=White kaolin stained with thin bands of red



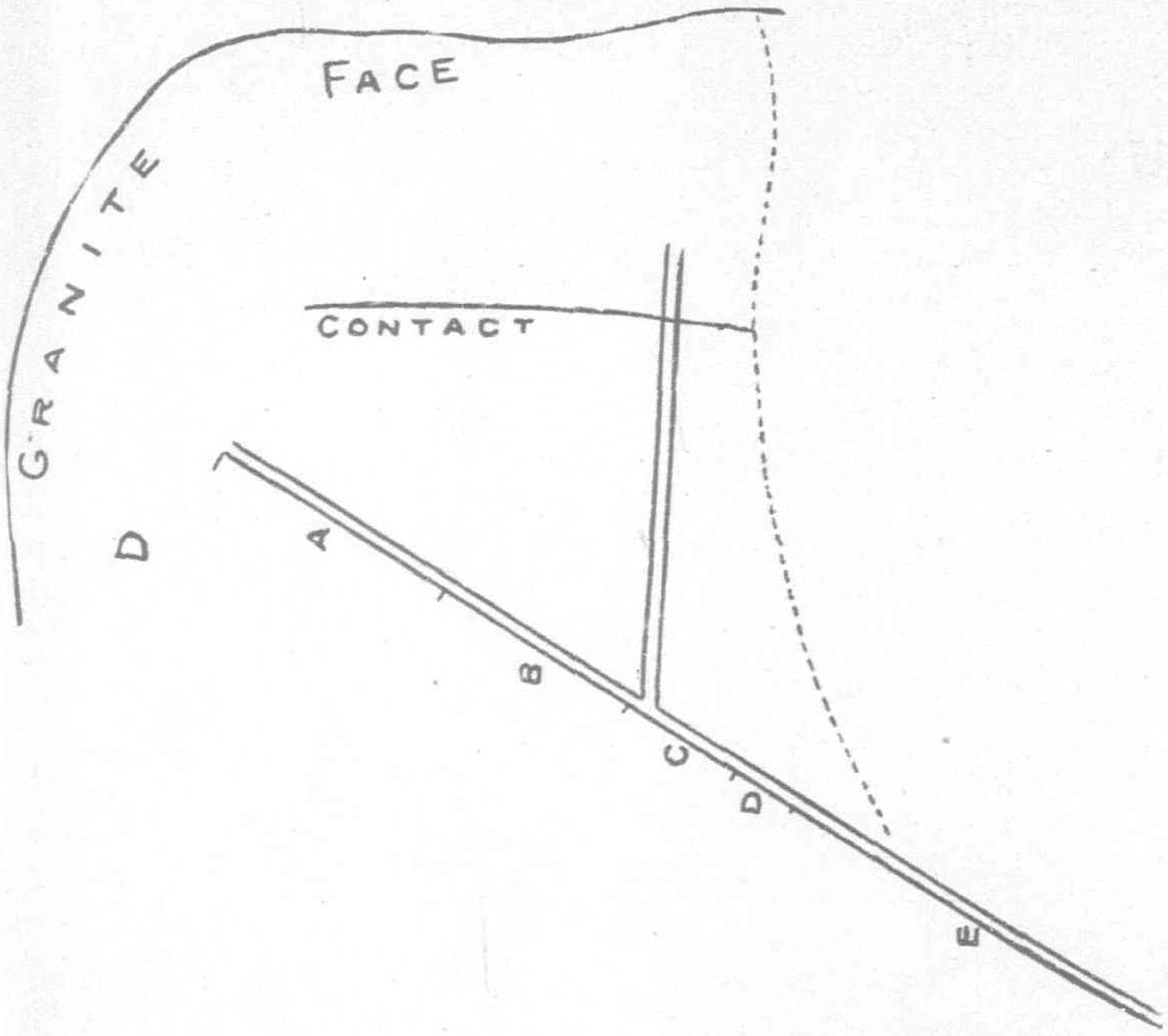
Washing Tin Ore in Sluice Boxes



Sluice Boxes

granite, to the right of the line, C, what appeared to be an included mass of clay was found. It was full of tourmaline. D is an altered mass of clay with mica-flourite-veins and tourmaline-veins. In the first part of the ditch, marked A, the clay is brightly-colored, streaky, contorted, and contains tourmaline-veins. shows part of this section. In the next part of the ditch, marked B, the veins and streaks are less pronounced and in the next, C, the veins are broken and fewer. Further on, at D, there are the remains of a few veins only, and from there onward clay with stones of quartz and quartz-tourmaline rock, etc., which are not portions of the veins in the other parts of the ditch. It is impossible to distinguish a line of demarcation between the clay with veins and the clay with boulders.

Fig. 17.



Above and resting on the altered mass of clay at D was a mass of the granite that had moved a little down the slope owing to soil-creep. The effect of the movement could be plainly seen. It contains weathered core-boulders of granite and kaolinized felspar crystals and the movement has just been enough to break veins of quartz and tourmaline.

There is little doubt that the soil with boulders above the clay on adjacent parts of the mine, and which is distinct from the underlying clay has been formed by soil-creep from this granite exposure.

The mine, commonly known as "Ulu Gopeng," behind the village of Gopeng, worked formerly by the Gopeng Tin Mining Co., and now by the Gopeng Consolidated Co., is of especial interest because on this property there are very good sections of the junction of granitic rocks rich in kaolin and hard phyllites, sandy phyllites that are evidently altered quartzite, and tourmaline-schist. The alteration extends a long way from the junction, indeed the sedimentary rocks do not seem to be more altered at the junction than many yards away from it.

The bedding of the sedimentary rocks is distinct and is inclined at a very high angle to the west. There are small contortions here and there. In the soil above the sedimentary rocks ferruginous and aluminous concretion, and also replacements of weathered rock preserving the structure, are abundant.

Tin-ore occurs in the granitic rocks and also in small veins cutting across the strike of the sedimentary rocks. Quartz-veins are abundant in the latter and reach six inches in thickness. From the hill on this property overlooking the village a good view is obtained of the rolling country between the east side of the valley and the Kinta River.

Lahat

The big opencast-cast mine at Lahat, worked by the Lahat Tin Mining Company, is the first, to show with any degree of clearness the relation of the Gondwana clays to the lignites and sands that form so marked a feature of the western side of the Kinta Valley. I have not sufficient data to justify a diagrammatic section of the mine and neighboring country owing to the impossibility of keeping pace with the development of every mine in the district, but information kindly supplied by a former manager, Mr. O. Dawbarn, and my own observations, show that the structure is in the main the same as in other mines where the lignites and sands appear.

On the west the mine is bounded by a hill of stanniferous granitic rocks. Lying up against these and dipping steeply eastward are stiff blue clays, with angular tin-ore, showing rough lamination and slickensides, that may be regarded certainly as Gondwana clays. Quartz-boulders occur. I have seen one section in which these clays descend vertically. Above the clays are a few thin seams of lignite and thick beds of stanniferous sands and clays. The tin-ore in the Gondwana clays is like that found at Pusing Baharu Siputeh ; but that found in the sands is, I am told, distinct from it. It may be derived in part, if not wholly, from the granitic rocks by denudation. The Lahat Mine differs perhaps from others in which the lignites and sands are well developed, in that the sands are relatively a more important source of tin-ore compared with the Gondwana clays.

Close to the blue Gondwana clays a section has been exposed showing an almost vertical bed of clay with pebbles and boulders, lying between light colored clays, that resembles some of the bedded deposits at Gopeng.

In December, 1914, limestone appeared in the bottom of the mine. Its dip was very steep to the E.N.E. There was an iron-capping and specimens of the limestone when dissolved away left a small residue containing quartz, white and brown micas, and green tourmaline. These are secondary minerals connected with the granite.

At the end of 1914 also, the granitic rocks exposed were rich in kaolin. Sometimes the kaolin contained quartz, sometime stringers of tourmaline. Much of the kaolin was of good quality, and pure white.

(To be continued).

Shanghai Municipal Electricity Plant

(Continued from page 382).

Whilst the 18,323-h.p. connected during the current year is not so great as in the previous year, it is indeed satisfactory to think that even with trade in its present state such increase can be recorded.

It might be worth while noting that the department has yet to reap the benefit of a large percentage of the plant recorded in this year's connections, as many consumers are still slowly building up their load owing to the depressed state of trade and general conditions.

The hired motors show a decrease in horse-power and numbers. The reason for this is largely due to the fact that consumers can now buy motors at cheaper prices than formerly, and they find it cheaper to buy rather than hire. The mills with hired motors installed continue to favor this method in preference to purchase, as the small decrease in horse-power shows.

The advantages of the three-phase alternating current motor for lift work in comparison with the direct current motor are at times overlooked when an order for such plant is being placed. Points to be considered are that a more reliable and cheaper motor can be installed, and that the rate for alternating current is approximately a third of the charge made for direct current.

Heating and Cooking

A satisfactory year has again to be recorded. The allowance made for the expected increase in hired radiators has sufficed to meet consumers' demands. A total of 3,076 radiators were connected at the end of December, of which 2,178 were hired from the department. This represents a load of 7,391-kilowatts.

The cooking apparatus connected during the year shows an increase of 104-kilowatts, the total connected load being 835-kilowatts, which makes a combined heating and cooking load of 8,216 kilowatts.

The major portion of the cooking apparatus connected this year is consumers' property, which would seem to indicate that the equipment is found reliable despite the bad usage it is sometimes subjected to by the native servant.

The Nanking Road showroom continues to be a source of assistance to consumers. A selection of electrical equipment for use in the home is displayed and explained, and advice given as to where purchases can be made.

The foreign staff at the end of the year numbered 153, and the Chinese staff 3,225. At the end of 1922 the figures were 159 and 3,163 respectively.

Chinese Turkestan

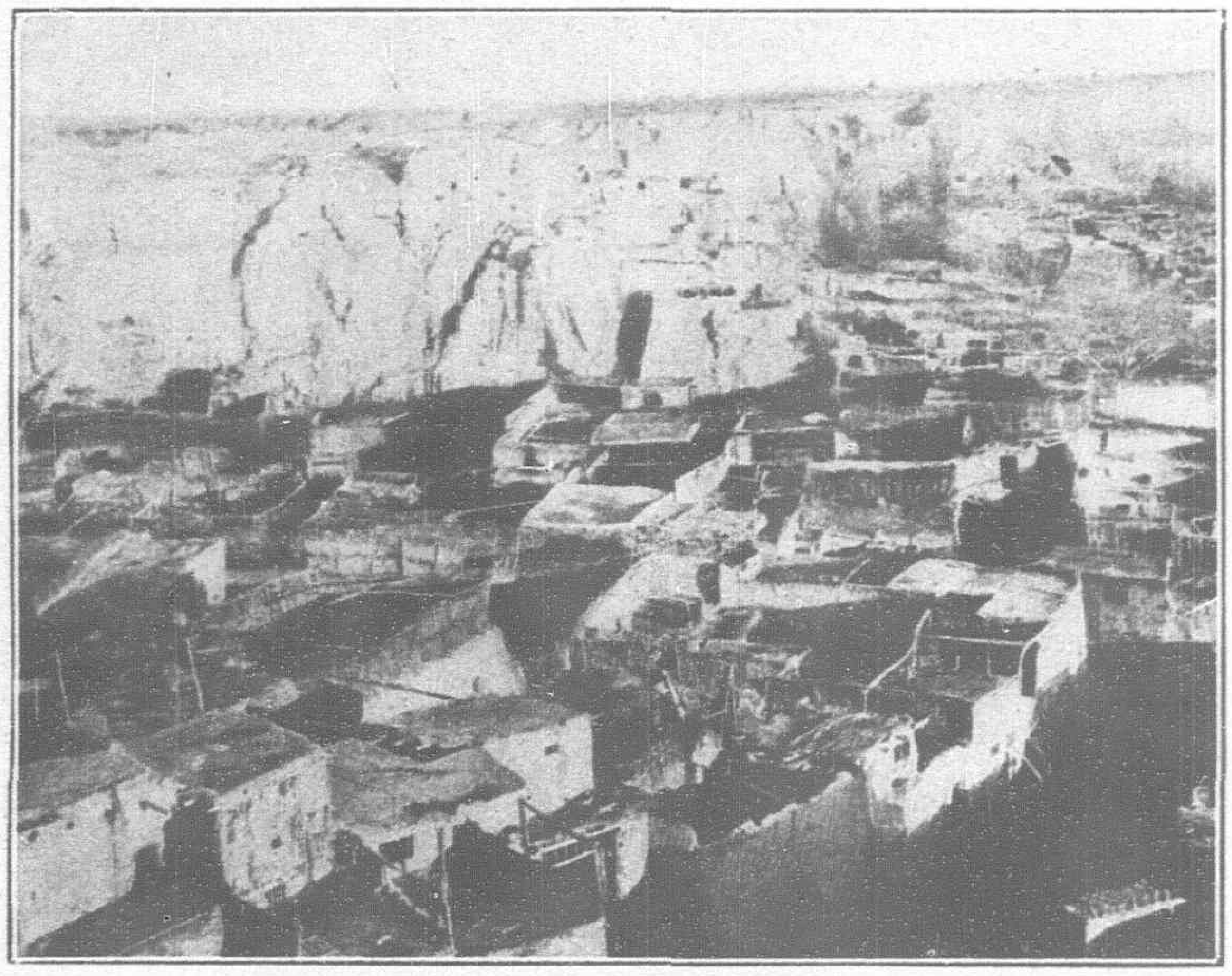
By Lieut.-Colonel P. T. Etherton

H.M. Consul-General in Chinese Turkestan; Author of "Across the Roof of the World"

CHINESE Turkestan, or the new dominion as it is known to the Chinese, forms an important part of the celestial empire, and in the following article I propose to deal with it from its various aspects, and to bring out its possibilities from a commercial and industrial standpoint.

It will be of interest to give briefly the geographical composition of Chinese Turkestan. It is bounded on the north by the Altai Mountains, on the east by the province of Kansu in China proper and the desert of Gobi in Mongolia, on the south by Thibet and the northern frontiers of India, whilst on the west we have Russian Turkestan and the Pamirs, more familiarly known as the "Roof of the World."

Speaking generally, the province is a land of oases, the arable parts being limited to the rivers and streams, and a narrow belt running along the foot-hills of the borderland separating Thibet and India from Chinese Turkestan. This belt is of no great width, but it marks the cultivable area, and is rendered fertile by the presence of rivers and streams which are brought to bear on the land by a system of irrigation worthy of explanation in detail. The rivers are first of all taken at the point where they issue from the mountains and divided into main streams, these in turn being split into canals and minor channels at the different villages and hamlets, whence the water is diverted on to the land. It will thus be seen that irrigation is the mainstay in the economic welfare of the country; the water question forms one of the leading features in the life of the people, and nothing gives rise to more frequent dispute and quarrel than the allocation of the water supply to the different parts of any given area.



The Sunken City of Aksu, Chinese Turkestan

The climate is the same as that of regions remote from the sea: in summer considerable heat, in winter corresponding cold. Humidity is almost nil, but a marked feature is the high wind prevailing in the spring with clouds of dust, enveloping the country in a haze that frequently takes several days to clear away.

The total amount at present under cultivation is about seven thousand square miles, a figure that could be very considerably increased if the Chinese were to adopt a scientific system of supply, such as we have in India and Egypt, so as to make all possible use of the water available. The amount of land suitable to cultivation is large, and could be expanded, with a resultant enhancement of trade and revenue. The distribution of the rural population is governed by the oases formed by the irrigation arrangements, and between and beyond them one finds large stretches of waterless country. This is particularly noticeable in the south in the vicinity of Khotan, famed for its buried cities and the ruins brought to light by the celebrated archæologist, Sir Aurel Stein, where one passes for several days through barren and arid country not yet made available to the cultivator.

The general features of the province present several interesting aspects, notably in the northern and central parts where the sandy tracts are less frequent, and the general physical formation of the land is a succession of low, narrow ranges of hills, the ground in the immediate vicinity being composed of sand and shingle which would not lend itself to cultivation however good the water supply might be. In the north, too, we find lakes, such as the Sairam Nor and the Ebi Nor, into which many of the streams flow, or not infrequently they lose themselves in the desert, as is the case in Seistan. In the southern part of the province we have large areas of ground covered with a saline deposit, but this brackish, salty soil is not confined to Kashgaria; it is met with all over the new dominion, salt impregnating the ground generally, and often cultivated fields present a snowy appearance from the amount of salt exuding from the soil.

From the above we see that the general geographical formation of Chinese Turkestan is a valley with an environment on the north, west, and south of high mountains. The depression itself is flat, with the exception of a range of hills known as Mazar Tagh, just north of Khotan, and an offshoot of the Thian Shan, near Karashahr, on the old Imperial road from Peking to Kashgar, known as the Kuruk Tagh. Although flat, Kashgaria itself is not low, but comprises a plateau varying from 2,700 feet above sea-level at Lake Lop to 4,277 feet at Kashgar. I have already indicated that the surrounding mountains pour many streams into this depression, the main river being the Tarim, on which Sven Hedin carried out a good deal of his exploration work. Beyond the Tarim lies the Takla Makan Desert, forming a great obstacle to any attempt to open the country from the east.

The bulk of the people are Turkis, a mixture of the original Iranian inhabitants of Central Asia the Tajiks, with their Turanian conquerors, the Usbegs. The Turkis are engaged in agriculture and commerce, and are Mohammedans of the Sunni order, many of them belonging to the Sufi sect. They are friendly to the foreigner, but show no marked desire for advancement or the development of their country.

The natural wealth of Chinese Turkestan is as yet unexploited, and herein lies a rich field for mining and commerical enterprise. Gold is found in the southern part of the province and in the mountains fringing the northern borders of Thibet. Copper is also much in evidence, coal is found at many points, whilst there are extensive deposits of ozokerit, or mineral wax, near Yarkand, and in the foothills of the Thian Shan, just north of Kuchar. Oil is also found near Kashgar, but the working monopoly is in the hands of the Tungan commander-in-chief, who exploits the wells on primitive lines, and commenced his development operations a few years ago under the auspices of a Swedish engineer who was a refugee from Russian territory. These oil-fields cover fairly extensive areas within fourteen days of the Russian railway, the oil and petrol being of proved quality.

The Chinese have not tapped the mineral resources, and would be unable to do so without the aid of foreign capital and enterprise, which they are chary of admitting from inherent dread of this leading to alien domination, and the ever-present belief that it is aiming at their sovereign rights. The opening out of the various mineral deposits would furnish material for export as well as supplying local requirements.

Of raw products, other than grain of all kinds, the principal are wool, cotton, and silk. The province could be made self-supporting, and the necessity of looking to the central government for a subsidy would disappear. It will interest merchants and others in

Europe and elsewhere to see some details of the silk industry of Khotan and its potentialities. Prior to the collapse of Russia, and the resultant cessation of trade with that country, the annual production of cocoons in Khotan amounted to well over a thousand tons. Since those prosperous days the production has fallen away to such an extent that it now only amounts to some 500 tons wet, giving an approximate yield of 165 tons of dried cocoons, this quantity producing about 38 tons of spun silk. Of this total about two-thirds are exported to India, the remainder being disposed of in the local market.

Notwithstanding the excellent quality of the silk, a defective method of reeling renders it of little use for the export trade, but this is a matter that up-to-date machinery and methods would readily overcome. There are three kinds of this spun silk, each rather coarse and irregular—*i.e.*, not spun with a given number of threads. The silk, however, leaves the "bassins" in regular threads, but the cost is high owing to the extra work required with such inadequate implements.

Another article that was formerly well known amongst the products of Chinese Turkestan is jade, but its general export and sale have fallen off in recent years, although there are extensive stretches of jade ground near Khotan; but the people are averse to disclosing them from the fear of being compelled to supply forced labour in the mines. In mediæval days the jade of Khotan was famed for its quality, and we know that jade implements were in use in Europe.

Agriculture may be considered the most important and widely spread industry, and the one on which the inhabitants depend for their existence, there being no import of foodstuffs from neighbouring states.

For the successful prosecution of trade and commerce the main essential is good arterial communication. Chinese Turkestan is deficient herein, the communications being on a par with the general administration of the province. Metalled roads do not exist, rough roads and tracks only are in evidence, and in the hills footpaths worn by sheep and goats.

The main trade route to India, with which country Chinese Turkestan has most of its commercial dealings, is from Yarkand to Leh in Ladakh, whence there is a direct road to Srinagar in Kashmir, and so to Rawal Pindi at railhead. It is thirty days' march from Yarkand to Leh by a road crossing some of the highest passes in the world, which, as a commercial route between two countries, is the loftiest in the universe. Owing to the great physical obstacles, trade is carried on at a considerable disadvantage, and every summer, during the period when the passes are open, a heavy mortality in baggage animals results. This is consequent on the high altitude, the desolate nature of the country traversed, devoid of grass or any kind of pasturage, and the different glaciers to be negotiated.

Of late years, the government of India has done much to mitigate the difficulties and hardships of this route by the construction of supply depôts for grain, the erection of caravanserais for the use of men and animals, and in generally assisting traders to overcome the natural difficulties confronting them. At points along the road improvements have been instituted and carried through with a view to rendering it easier, so that it is now very different from what it was a few years ago. The road will, however, never be an easy one for the reasons enumerated above.

Leh, the capital of Ladakh, has from time immemorial been the link between the commerce of Central Asia with India, and when Russian activities in Central Asia threatened to endanger this ancient connection, it was thought that the trade might cease with the extension of the Russian railway to Andijan in Russian Turkestan, some thirteen days' march from Kashgar, whence there is rail communication with Europe and the Near and Far East. This was a great and obvious advantage over the long and arduous journey from India. The construction of this railway provides a comparatively cheap and rapid means for dealing with the mineral and other products of Central Asia, and, with the establishment of a stable government, efforts will undoubtedly be made to tap this new and promising ground.

There is another and possibly cheaper method of communication, via the Black Sea to Batoum, thence by rail to Baku on the Caspian Sea, and across to Krasnovodsk, the starting-point for the Andijan railway.

Brief mention should be made of the potentialities of the cotton and jute industry of Chinese Turkestan. Both are of excellent quality, and could be turned into a thriving trade if exploited on scientific lines; for the soil, labour, and material are at hand to co-operate with exploratory enterprise.

Surveys have been made in a perfunctory way for the laying of a railway from railhead in China proper to Turkestan, and the proposed track has been selected as far as Urumchi, fifty-four day's march to the north-east of Kashgar, but beyond this nothing has been done.

With the resumption of normal conditions in Central Asia there will come a trade boom, and it is of interest to detail the articles which will command a good market:

Household utensils: all kinds.

Hardware: Axes, screw-drivers, hammers, locks, hooks, horseshoes, chisels, files, saws, carpenters' and blacksmiths' tools, enamelled ware, lamps, heating stoves for coal, wood, and oil.

Ploughs, harrows, mowers, reapers, sickles, and threshers.

Dairy appliances and utensils.

Machinery for factories.

Foodstuffs: Groceries, salts, vermicelli, sago, tapioca, tea, proprietary articles, patent medicines, etc.

Articles of clothing: Boots and shoes, dress materials, cotton goods, blankets, underwear, etc.

Miscellaneous articles: Drugs, medicines, dyes, paper, stationery, and material for setting up printing presses.

The above list applies to both Russian and Chinese Turkestan; indeed, the larger demand will occur in Russian territory, where the population is more advanced, and where there is a higher standard of civilization and culture.

New Locomotive is Evolved by Ingersoll-Rand & G.E. Co.

A NEW type electric locomotive, using oil for its fuel, the first of its kind ever built in America, has been built jointly by the General Electric Company and the Ingersoll-Rand Company. This has been especially designed for switching service and will be given its first practical test by the New York Central in its freight yards at 11th Street, New York City. The power plant equipment consists of a 300 horse-power oil engine manufactured by the Ingersoll-Rand Company, directly connected to a 200 kilowatt general electric generator. The motive power consists of four-HM-840 motors, one geared to each of the four axles. The unit weigh 60 tons, all on the drivers.

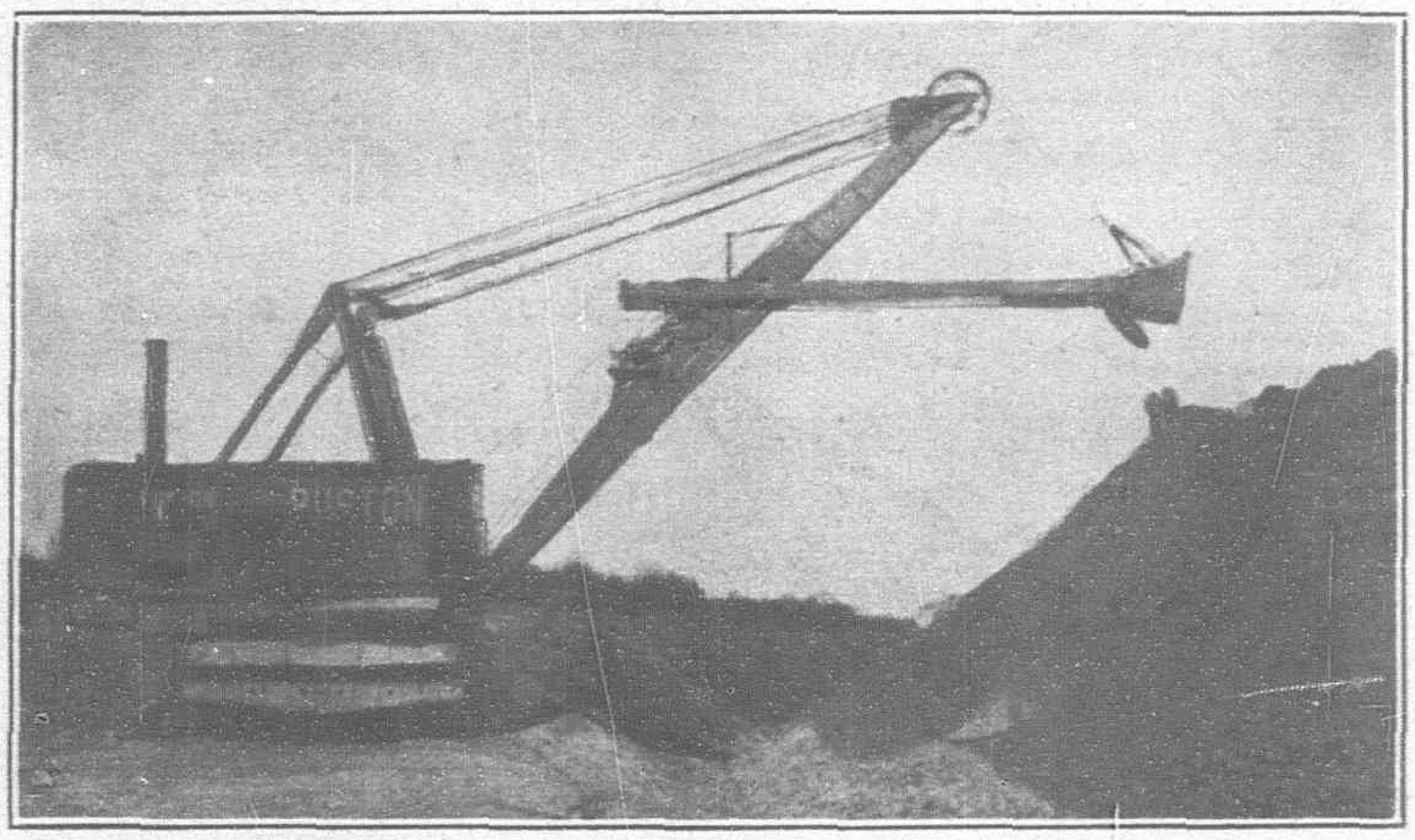
The General Electric Company has had extensive experience during the last 15 years in the construction of self-propelled motor cars and locomotives using gasoline as fuel. About 90 equipments have been put into service during this period and most of them are still operating. In order to take advantage of a low priced fuel in the internal combustion engine an arrangement was made with the Ingersoll-Rand Company to build an engine designed for the use of fuel oil and having characteristics of speed and weight that would be suitable for a locomotive. The locomotive has been in use in the yards of the Ingersoll-Rand factory at Phillipsburg, N.J. for about four months.

The Ingersoll-Rand unit is a six-cylinder engine designed to burn fuel oil and having the features of the well-known Price system of direct fuel injection. This system avoids the use of high pressure injection and also is said to make a reduction in weight, an improvement in mechanical efficiency and an increased simplicity and reliability. All parts of the cylinders, cylinder heads and combustion chambers are water cooled. The water from these water jackets passes to a radiator located on the roof and a thermostat maintains an even temperature regardless of weather conditions. Sufficient fuel can be carried for 48 hours continuous switching service.

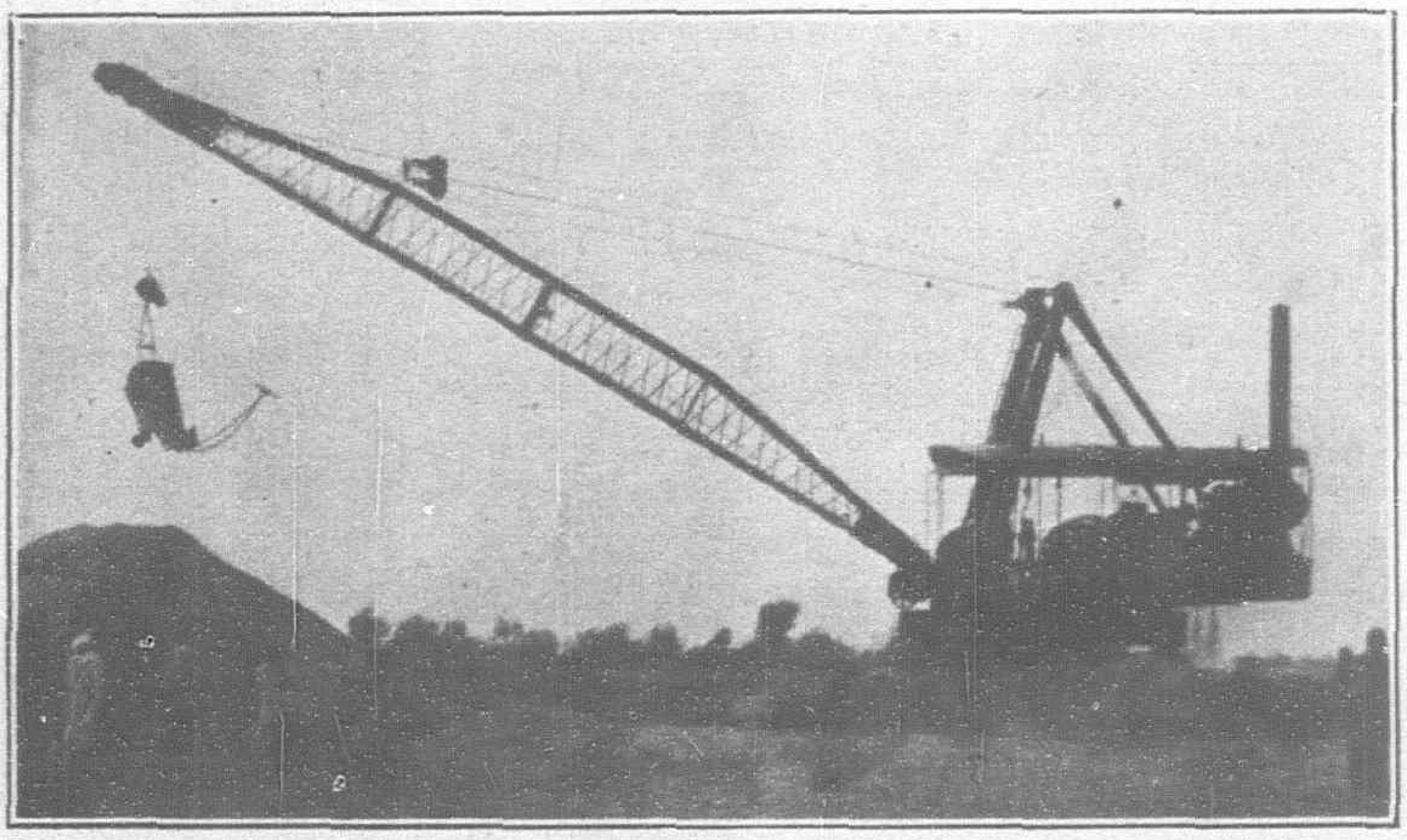
Due to its high economy, (about 0.43 pounds of fuel oil per brake horse-power) the engine is free from smoke which renders it particularly suitable for service in cities or in places where smoke is objectionable. As ordinarily used in switching service, the 60 ton locomotive consumed about 20 to 26 cents worth of fuel oil per hour.

Progress in Large Excavating Machinery

THE largest excavator of the dragline type fitted with a jib 120 feet long and a bucket of 8 cubic yards capacity, was sent out to India in the summer of 1923 for the excavation of large irrigation canals in the Punjab. It was constructed by Messrs. Ruston & Hornsby, Ltd., of Lincoln, and was the largest excavator of the single bucket type ever constructedd Great Britain. It was of the full circle type, steam driven and the traveling gear was specially designed to allow the machine to travel over uneven ground without distorting the framing. This was accomplished by means of four bogies arranged upon a three-point suspension. The total weight of the machine was 285 tons, or about 320 tons in working order.



From reports to hand, the machine is giving great satisfaction, and has excavated over 3,000 cubic yards in a working day of 9 hours. A repeat order for a similar machine was received in October 1923 ; delivery was commenced two months later, and completed three months after receipt of the order, which was a practical test of the manufacturing facilities in the large new excavator works at Lincoln for the manufacture of excavating machinery. Repeat orders are the best recommendation a firm can receive, and six more of these large machines have been ordered for use in India. They are of a still heavier type than the first machine sent out. This is probably the largest single excavator order which has ever been placed for irrigation construction.

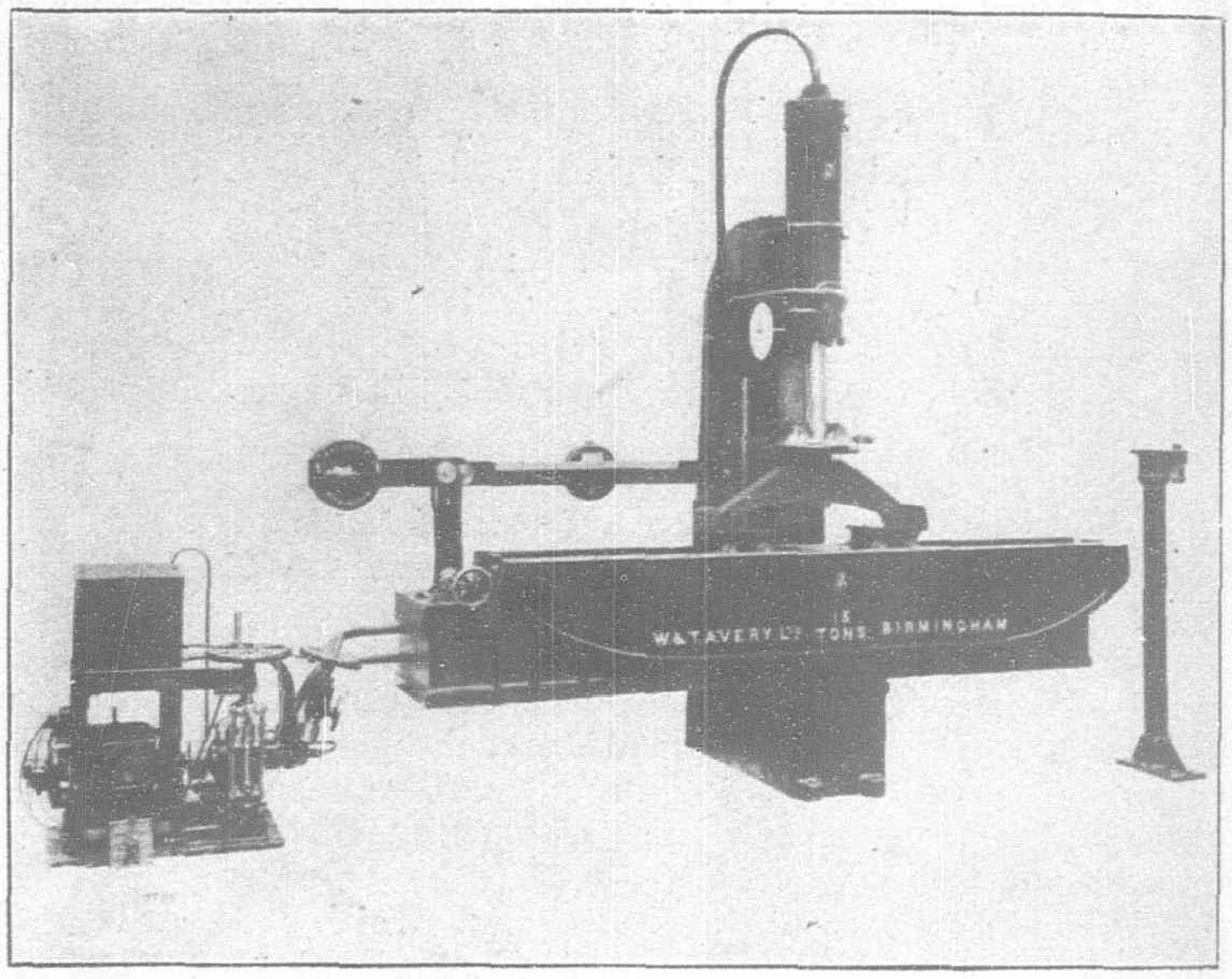


The dragline type of machine excavates below the level of the ground upon which it stands, in contradistinction to the usual steam-navvy or shovel type, which works upwards or only above the working level of the machine. The one, however, is readily convertible to the other by fitting either steam-navvy or dragline type of jib and bucket, as required. The largest machine of the steam-navvy type, weighing 300 tons and fitted with a jib 80 feet long carrying a bucket of 7½ cubic yards capacity, manufactured by Rushton and Hornsby, Ltd., is successfully removing cover from an ironstone quarry in Northamptonshire.

Another machine of the same size and type but electrically driven, is under construction for the excavation of a large deposit of brown coal in Australia. This deposit varies from 120 to 180 feet in thickness, and the working scope and radius of this large machine is such that from 60 to 70 feet of coal can be excavated in a single cut. In addition to the large machines mentioned above, Messrs. Ruston & Hornsby, Ltd., are manufacturing smaller machines weighing from 18 tons upwards, and at the present time have many on order of various sizes both for home and abroad.

Testing Machine for Railway Springs

THE heavy laminated and coil springs used on railway rolling stock are at present receiving special attention by railway engineers, on account of the increasingly heavy loads and rough usage to which present-day rolling stock is being subjected. Not only are the springs being tested for deflection under the loads they have to carry, in order to standardise the rate of the spring, but vibratory tests are also being applied to ensure that the springs are capable of withstanding suddenly applied loads. The machine shown in the illustration has been designed and manufactured by W. & T. Avery, Ltd., of Birmingham. The maximum loading capacity is 20-tons, but the same type of machine in varying capacities up to 40-tons has been constructed by this firm for spring makers



Two of these Machines have been Constructed to the order of the *Egyptain Government for use at their Railway Depots*

As will be gathered from the illustration, the machine consists of a weighing mechanism of the well-known " Avery " lever type, upon the table of which, the spring to be tested is placed. The pressure is then brought to bear upon the top of the spring, through the medium of a double acting hydraulic cylinder working with oil, the supply being derived from a motor driven hele-shaw pump unit. In using the machine the poise upon the steelyard is set to succeeding increments of load, and the hydraulic ram brought to bear upon the spring until the steelyard is balanced. The corresponding deflection of the spring for each load increment in then noted. Similar records are also made for the return stroke of the ram, and the results compared with the former figures. By this relation of the two series of figures, the internal friction of the spring can be ascertained.

In addition to the foregoing deflection test, the spring can be subjected to a vibratory test, and be compressed solid. This test will at once show if the spring has any tendency to take a permanent set, and also reveal any signs of brittleness due to shock. For the load-deflection test the pump is operated by a handwheel placed in a convenient position for the operator. Sustained loads can be maintained upon the spring by the use of a suitable valve.

The deflection of the spring under the applied load is shown upon the graduated scale attached to the main standard of the machine. A dial indicator is also supplied for showing automatically the compression of the spring.

Two four-wheel trolleys are provided, upon which the two ends of the laminated springs are seated, and a loose circular platen is also supplied for the purpose of testing coil springs.

Spring in tension can be tested by the provision of a separate standard which is bolted to the upper surface of the platform. The upper end of the spring is connected to a lug upon the standard, while the lower end of the spring is attached to the crosshead of the ram.

Mineral Developments in Burma

By H. H. Johnson, M.Inst.M.M., M.I.Mech.E.

A GOOD deal of interest has recently been aroused in the mining possibilities of a large zone of mineralized country in the southern Shan states, Burma. The notes herewith presented give some information as to this region of activity. They have been compiled as the result of several visits to the locality during the past two years.

Burma, as is well known, is one of the provinces of India, but it is separated from the main portion by the Bay of Bengal, the journey by sea between Calcutta and Rangoon, the capital of Burma, taking about 50 hours. From Rangoon the main line of railway runs north to Mandalay. From Thazi junction, a point on the main line 300 miles from Rangoon, there is a branch line known as the southern Shan states branch, which climbs up to the Shan states plateau to an elevation varying from 3,600-ft. to 4,400-ft., and terminates at Heho some 98 miles to the east of Thazi junction. Incidentally it may be mentioned that from Mandalay the railway swings north-east and climbs up to a similar elevation on the same uplands, there known as the northern Shan states, in which the great Bawdwin mines of the Burma corporation are situated. The two lines in the Shan states thus run roughly parallel to each other, and are separated by about 90 to 120 miles of rough and little known territory. On each of these lines there has been developed a popular hill station suitable for European settlement, the northern one being Maymyo, which is also the summer seat of Government, and the southern town Kalaw at an elevation of 4,200-ft. above sea level.

A mile or so east of Kalaw in the Southern States a good quality of coal has been found in limestone and shale formation, and a considerable amount of work has been done in an attempt to open it up commercially. Unfortunately the present indications are that the deposits are so uptilted, crushed, controted, and lenticulated that it is doubtful whether the coal will prove of economic value. This is the only true coal that has been found in Burma, although there are vast deposits of lignite in large and widely scattered areas. It had been hoped that the Kalaw coal would prove to be of great value to the province especially as it is of good coking quality, and coke has at present to be imported in large quantities and at high cost. Owing to its crushed nature the coal lends itself readily to washing and briquetting, and large scale tests of these briquettes have given excellent results as locomotive fuel.

An analysis of Kalaw briquettes gives the following results :— Fixed carbon, 58.0 per cent.; volatile matter, 30.92 per cent.; ash, 10.0 per cent.; moisture, 1.08 per cent.; calorific value, 13,910 B. T. U. This compares of course very favorably with the average Indian coal upon which Burma is now dependent, which has a calorific value of about 10,500 B. T. U.

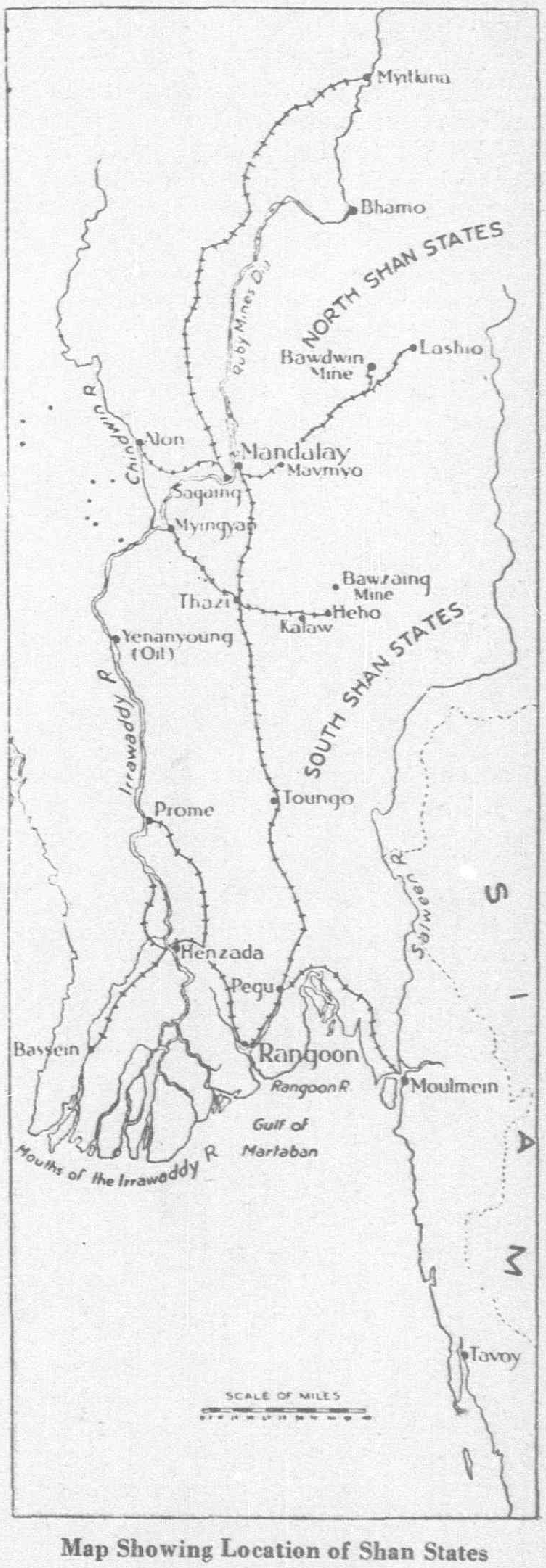
The advent for serious mining for coal attracted several engineers to the district, and perhaps in consequence of this, the large runs of old workings some 25 miles further east, from which samples of lead, copper, and other ores were frequently brought in by natives, received particular attention.

As regards the old silver-lead workings here, during the last two years or so large areas have been applied for under prospecting licences over a stretch of country about 8 miles wide and 30 miles long in the neighbourhood of Heho, on the railway about 25 miles east of Kalaw. This country generally consists of sedimentaries, limestones and shales predominating, with a very regular general north and south strike. Primitive mining for silver and lead is known to have been carried on in the Yaunghwe state, in which Heho is situated, for many years, possibly centuries, before the British occupation. The surface in many places is riddled with old workings, the custom having been for each family to burrow its own way into the ore, each resenting neighbors breaking through into his own mine. It is well-nigh impossible to enter these warrens to-day, but there is evidence that some of the workings were carried down to a vertical depth of over 200-ft.

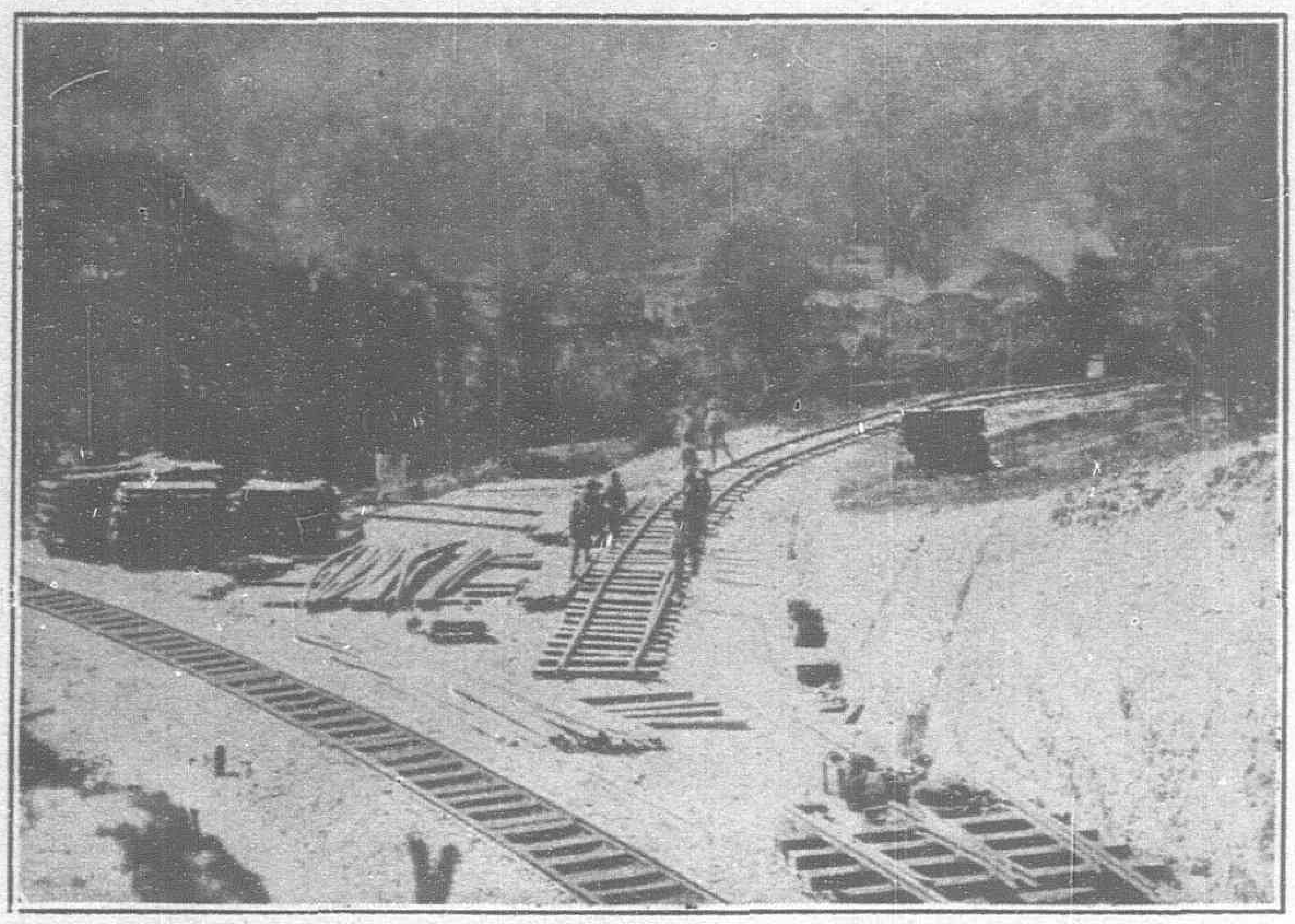
The lodes so far reopened are stockworks, consisting generally of limestone boulders much corroded, around which run veins of practically pure galena bedded in a reddish plastic clay. The system of the ancient workers was clearly to follow the clay and galena, leaving behind the boulders which were too hard or large to extract.

A well-known firm of Rangoon merchants has begun extensive prospecting and development work under the superintendence of Messrs. John Taylor and Sons, and several shafts are now being sunk, some 16 miles north of the railway in fine open undulating country.

The Shan states Silver-Lead Corporation, Ltd., has taken over the interests of the Kalaw Mining Syndicate, and is concentrating its energies for the moment on opening up a very promising area known as the Bawzaing mine, about 18 miles north of Heho, and about 2 miles from the before-mentioned operations. At Bawzaing a two-compartment vertical shaft has been sunk 275-ft. For about 100-ft. it passed through old workings, in all of which good ore was found, and it has now proved two lodes separated by about 10 to 20-ft. of limestone, the aggregate width of which without partings is just under 90-ft. The original syndicate put up a small washing and jigging plant to treat ore received from development, from the proceeds of which they were able to pay expenses. The first shipment of 11 tons of concentrates assayed: Pb, 72.0 per cent.; Ag, 25 oz.; Cu, trace ; Zn, Nil; As 0.05 per cent.; Fe 0.93 per cent.; Si, 1.2 per cent.; CaO, 9.8 per cent. The next shipment of 22 tons also assayed 72 per cent. lead and 20 oz. silver. Production has been stopped now for a few months to enable a permanent water supply to be provided, and to allow development to be pushed as fast as possible. Stations and cross-cuts have been made at the 120 and 200-ft. levels, the latter being in over 68-ft. in excellent ore. It is too early yet to place a definite value on the ore met with so far, but as a conservative estimate it appears that these lodes average 12 per cent. lead and about 3 oz. of silver per ton. The striking feature of the ore is its freedom from troublesome complications, and the extraordinary facility



Map Showing Location of Shan States



First Railway Siding to the New Mining Area

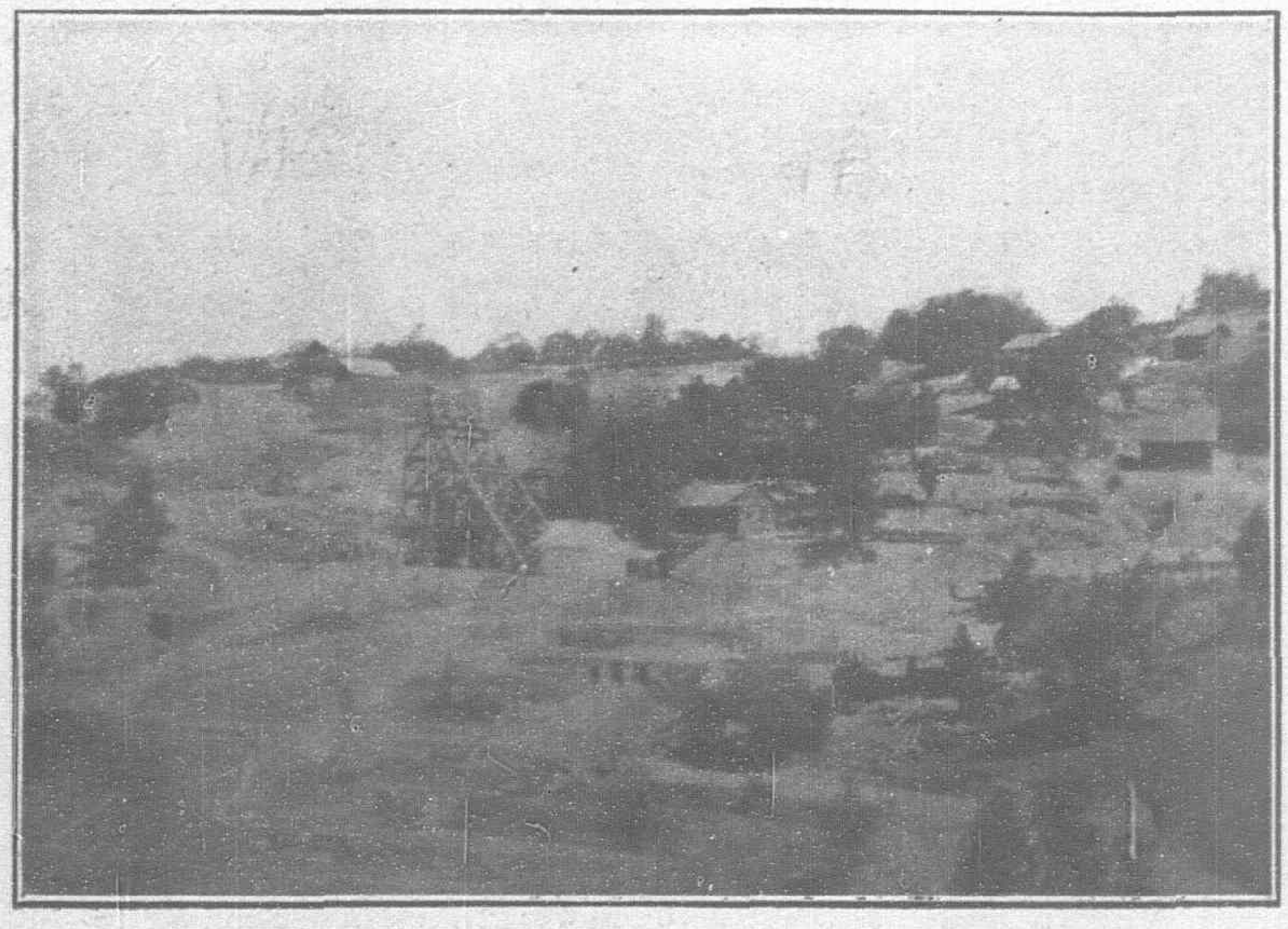
with which it lends itself to mining and concentrating by the simplest methods. Very little lateral work underground has been done so far, as all efforts are being directed to getting well down under the old workings and thus proving the deposit in depth.

So far as surface indications go there are several areas with all the appearances of the Bawzaing area which are awaiting development, and some even more favorably situated in relation to the railway.

Within the last few months a very interesting discovery of copper has been made within a mile of Heho station. Four lodes have been traced on the surface and by old workings for several hundred yards, with widths varying from 11-ft. to 25-ft. Samples of these outcrops show much weathered quartz and limestone impregnated with malachite and azurite, changing in a few feet of depth to bornite or chalcocite. These samples assayed for copper vary as follows: Main lode, 8.49 per cent.; ditto, 13.36 per cent.; ditto, 19.07 per cent.; east lode, 4.34 per cent.; No. 2 lode, 4.29 per cent. An analysis of the sulphide ore gives the following results: —Ag, 37.5 oz.; Au, 0.07 oz.; Pb, 0.20 per cent.; As, 0.05 per cent.; Sb, 4.0 per cent.; Fe, 5.0 per cent.; Zn, 0.5 per cent.; Co and Mn, 0.5 per cent.; Bi, Nil; Si, 46.0 per cent. Further work is being immediately undertaken on this property.

Within three miles of Heho and the copper area there is a fine natural waterfall of 777-ft. vertical in a horizontal distance of 4,000-ft. capable of developing at the end of the dry season upwards of 3,700 h.p., and steps are already being taken to develop this as the mining requirements may warrant.

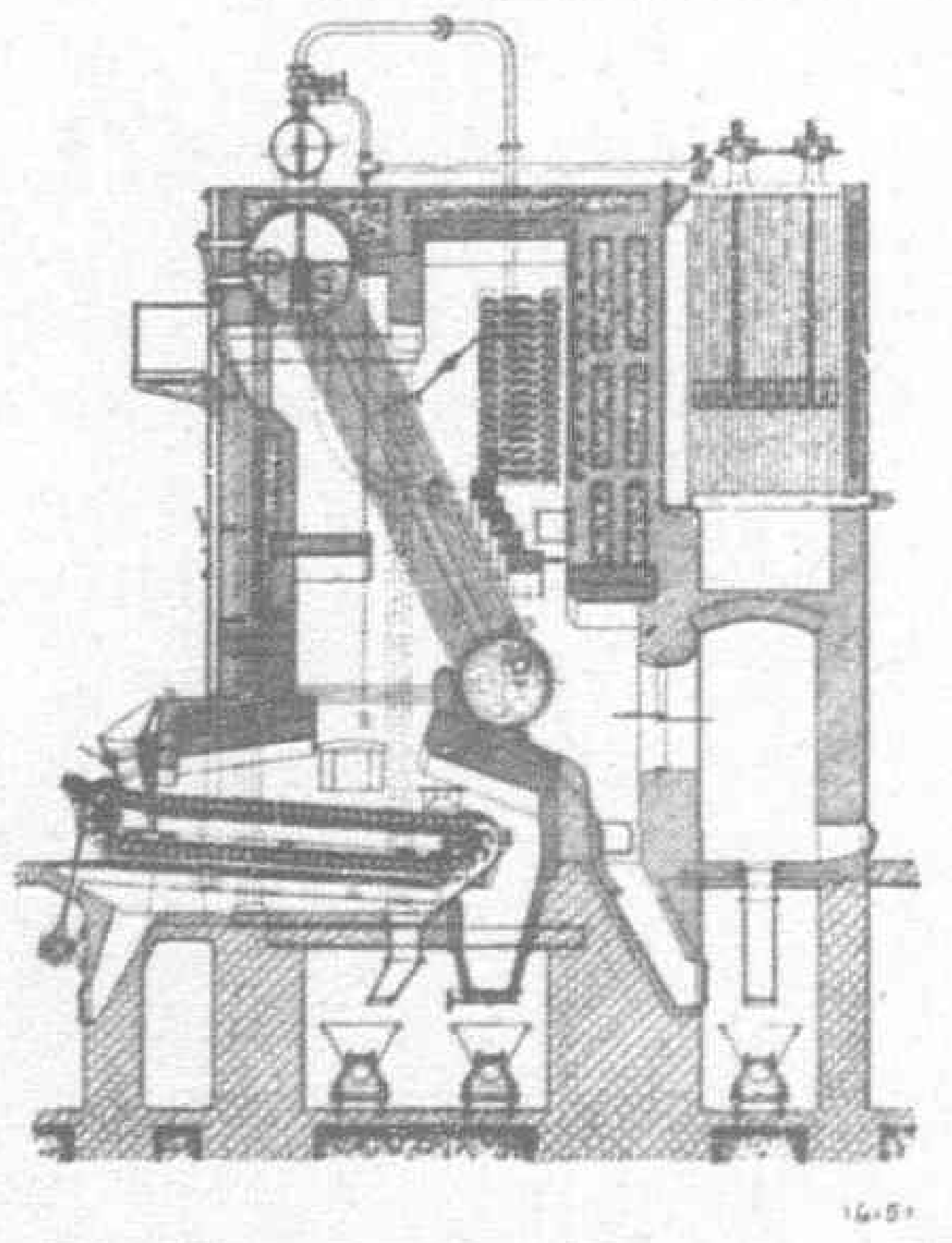
For a new field, mining conditions are singularly good. At an average of about 4,000-ft. the climate is almost ideal for Europeans, and there is very little malaria. Rainfall varies from 40-in. to 60-in. between May and November. Fair supplies of mining timber are available, though the country generally is open rolling land with ridges of hills. Native villages are scattered, but there is a fair supply of mixed Shan, Chinese, Burmese, and Indian labor and as much as may be needed may readily be attracted under good conditions at about 30s. per month and rations. The mining laws are practically the same as those throughout India, and are fairly and ably administered. Railway facilities—within 400 miles of Rangoon—are good already, and no doubt these will readily be extended as required, for the country presents no difficulty. Roads for country carts are available almost everywhere, and during the dry weather motor-cars can generally be used, but the main tracks require metalling and it is understood that the government is already moving in the matter. There is thus every reason to expect rapid development on the field, and certainly the attractions for the expenditure of a moderate amount of capital in many directions are very great. It is certain that much more will be heard of this locality shortly.—*The Mining Magazine.*



The Kalaw Coal Mine—Southern Shan States

Oil in New Guinea

Whilst all local reports of the discovery of oil are subject to reserve, the prospecting party organized by the Mandated Development Company is extremely optimistic regarding recent finds in German New Guinea. Members of the party who have returned to Sydney state that the company selected an area stretching along the northern coastline of the mainland of New Guinea to the Sepik River, including the authenticated Seepamees, and also the site selected by Dr. Schlenzig, the German geologist, in 1913. Boring commenced in May, and gas indications of oil soon appeared. The bore was carried to a depth of 70-ft. and the flow continued until 40 gallons daily were obtained. Fifty gallons have been brought to Sydney. Meanwhile, Mr. Spencer, the leader of the expedition, has, in a wireless message, expressed the opinion that an oilfield of commercial importance has been discovered. Mr. Ross, who was formerly engaged in the operations of the Anglo-Persian Company in Papua, and who has had 25 years' experience of American oilfields, states that he could not say that America has anything to equal the possibilities of the area, and that it is unquestionable that the oil struck must be backed by tremendous volume at a greater depth. The site of the bore is 54 miles from Aitape, in Northern New Guinea.



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Engineering and Industrial Notes

BRIDGES

RAILWAY NEEDS BRIDGES.—Replying to a telegram from Marshal Wu Pei-fu inquiring as to the loss of the government railways due to the floods, it is reported that the ministry of communications has given the figure of $2,400,000 for the Peking-Hankow and Peking-Suiyuan lines. Because of the eighty breaks, and the destruction of five large and two small steel bridges the Peking-Hankow Railway suffered a loss of two million dollars.

BRIDGES ON KIAO-TSI RAILWAY.—The Kiaochow-Tsinan railway administration has concluded agreements with the successful bidder, a German firm, for the construction of a bridge at Lokow, Shantung province, and other bridges along the railway line. Work started August 1.

STEEL BRIDGE ON KIN-HAN LINE.—The ministry of communications has ordered the Peking-Hankow railway administration to invite tenders for a steel bridge to be built at Sinlo, Chihli province, south of the site of the former stone bridge, to replace the temporary wooden bridge. It is to be 60 metres long with eight arches. Its foundation is to be sunk 20 metres below the river bed. The cost of construction is estimated at $1,500,000. After completion, the present steel bridge on the north will be reconstructed so as to form a straight line with the new bridge.

BUILDINGS

YOKOHAMA SPENDING SIXTY MILLIONS.—The Yokohama municipal office has mapped out plans of rehabilitation of the port at an estimate of Y.60,000,000 to be obtained from the Japanese authorities in the form of a long-term loan. In addition, the Yokohama branch of the Tokyo rehabilitation office with Y.50,000,000 will undertake the construction of 21 iron bridges and other works which are of such character as to be carried out by the central authorities. Of the above estimate, Y.3,000,000 each, is allotted for the rehabilitation of a waterworks system and the gas enterprise, Y.8,500,000 for the rehabilitation of electric business, Y.6,188,000 for the widening and repairing of roads, Y.4,179,000 for the adjustment of lands, Y.6,000,000 for the repairing and dredging of rivers and canals, Y.1,250,000 for the construction of sewerage system, Y.3,750,000 for the repairing of the Yokohama memorial hall and Y.1,100,000 for the construction and repairing of parks, of which Y.800,000 will be spent on the reconstruction of the Yokohama park and the balance for enlarging Kamonyama park and creating a new park along the bund at Yamashita-cho which was reclaimed to the extent of some 100 feet in width. The above works will be started early next month.

NEW BUILDINGS IN TOKYO.—A new seven-story office building to be known as Mitsubishi No. 28 is to be erected by the Mitsubishi Company on the site of the wooden barracks from which the Yokohama Specie Bank recently removed. The new building will cost Y.1,000,000 and is to be completed by the end of 1925. The Mitsubishi estate contemplates also the erection of a building with 18,000 *tsubo* floor space, 1,000 more than the Marunouchi building, on the now vacant site directly north of the Marunouchi building and east of the Kaijo building. The plans for this building are, however, still indefinite.

ELECTRIC

SSUPINGKAI ELECTRIC PLANT.—The new electricity works for the Chinese town of Ssupingkai, Manchuria, according to Prefect Yin of Lishu, has its S.Y.120,000 the capital in 1,000 shares of S.Y.129 each, paid up. About two-thirds of the machinery has been received, and the construction of both power house and office is to be started at the end of this month. Two cooling water wells are under excavation. The subscriptions to the lighting service have exceeded 2,400 lamps, and are expected to reach 3,000 lamps soon. The machinery is furnished by the Siemens China Co., and the daily consumption of coal for fuel is about 1 ton.

Mr. Wu Pei-shan, manager of the branch of the bank of communications in the new town, a graduate of the electrical engineering course of the Tokyo Technical University College, drew the design for the new works.

LIAOYANG-MUKDEN POWER LINE.—Tests of the new line for transmission of power from Mukden to Liaoyang, are finished and the line stood up under trial transmission of current of 55,000 volts. The switch-boards indoors and the transformers installed outdoors were subjected to high pressure tests. To begin with, 1,000 kilowatts are to be supplied to the Manchuria Spinning Mill, Liaoyang, until October, also 150 kilowatts to the railway repairing shops. At present, 14,110 lamps are installed at Liaoyang. The existing power station is to be held as a reserve for the time being.

SINGAPORE POWER PLANT.—The Singapore municipality has purchased land in the neighborhood of St. James' Walk for the construction of the new municipal electrical power station. The amount paid to the owners, Mr. S. Q. Wong and others, is said to have been nearly one million dollars.

SSUPINGKAI ELECTRIC WORKS.—The installation of an additional generator at the Ssupingkai Electric Light Co., which has been delayed owing to the destruction of the Shibaura plant, Tokyo, in the earthquake, will be made at the end of August.

AMANOGAWA POWER HOUSE.—In order to supply power to the new spinning mills, nearing completion at Choushuitzu north to Dairen station, and Chinchou, a new turbine of 5,000 kilowatts has been installed at the S.M.R. Co. Power House, No. 2, in Amanogawa, Shakako. The work was begun in April. The power house now is generating 10,000 kilowatts.

ELECTRIFY KUSATSU RAILWAY.—Electrification of the present fifteen miles of track laid, and its extension as far as Kusatsu, the spa at the foot of Shiranesan, is the plan of the Kusatsu Tetsudo Company which now operates a light railway from Karuizawa station to Tsumakoi, some twelve miles. This light railway was put into operation in 1914. The company's capitalization has been increased to Y.2,000,000, to carry out the electrification and extension of the line.

S. M. R. ELECTRIFICATION.—The S. M. R. Co., has completed its plan to electrify the trains operated on Dairen wharves and on the Fushun branch line, to economise in operating costs, and to turn to good account what is called coal shale or rubbish.

The Company intends to set apart an appropriation of Y.37,000,000 for the construction of electric locomotives, to be undertaken over 2 years from 1925.

Under the existing steam system, on the Dairen wharves, the annual total costs are Y.485,000 as against Y.408,000 for the electric trains per annum.

As to the Fushun branch line, in addition to economizing the expenses, the following advantages will be secured:

Coal shale and other by-products may be utilized. Communications between Fushun, where power is generated, and Mukden, whereto power is supplied by Fushun, will be materially improved. It has been found that the readiest way to utilize non-saleable coal shale, is by low temperature dry distillation, to convert it into power gas for operating trains and valuable by-products such as sulphate of ammonia and coal tar derivatives.

INDUSTRIAL

ABATTOIR FOR SEMARANG, N.E.I.—The Semarang municipality has been authorized to float a loan of 1,100,000 guilders (the guilder = $0.40), which, when realized, will be appropriated as follows: Construction of abattoir, 830,000 guilders; general building, 200,000 guilders; laying of water mains, 50,000 guilders; and miscellaneous, 30,000 guilders. (Trade Commissioner Jesse F. Van Wickel, Batavia, Java.)

EXTEND P. I. SUGAR CENTRALS.—All mechanical improvements, looking toward greater sugar production by the Philippine National Bank centrals in Negros, the Philippines' greatest producing centre, are provided for in contracts for new machinery and equipment, awarded to various Manila firms during the last few weeks, details of which were made public recently. New mill additions will be constructed. More transportation equipment will be added. Better electrical equipment has been provided. More than P.3,500,000 will be expended on the additions.

The Earnshaw Docks and Honolulu Iron Works have been given the contract for the extension to the Ma-ao Sugar Centrals company. This includes a new mill, vacuum pans, centrifugals, and general equipment.

The Catton-Neill Engineering and Machinery Company has been awarded the contracts for the centrifugals, pumps and electrical equipment for Isabela and Ma-ao centrals. The Catton-Neill Company is also furnishing the new boilers. Additional installation of equipment at Talisay is being built by the Earnshaw Docks and Honolulu Iron Works Company. This company was the original builder of the Talisay plant. The additional equipment will bring the plant to capacity in all departments. Approximately 2,000 additional daily tons of transportation equipment, including cars and locomotives, is being purchased from the Koppel Company and the Pacific Commercial Company.

Two large warehouses are to be installed soon at Pulupandan and Hinigaran. Contracts have not yet been awarded. Fifteen hundred feet of wharf is to be extended to the present Bacolod and Talisay wharf. This will give greater loading capacity with ships enabled to go up to the dock for bags of sugar at low tide and during the entire day. At present, loading is handicapped.

HAIPHONG GLASS FACTORY.—French firms now are pursuing the policy of setting up factories abroad and one of the latest arrangements of this kind has been made by a number of glass manufacturers. The Société de Terreries d'Extreme-Orient is an association representing the Société de Saint-Gobain, the Société de Glaces Nationales Belges, the Société Financiere et Coloniale, the Distilleries Indo-Chinoises, and the Société de Chimie d'Extreme-Orient. This organization contemplates doubling its capital of 5,000,000 f., and as a means of keeping a hold on the Far Eastern market, will supply buyers there with goods from factories at Haiphong, Tonkin.

DAIREN'S PLATE GLASS FACTORY.—The erection of the new plate glass factory by the S. M. R. Co. ceramic experimental institute at Dairen, is making fair headway. The warehouse has already been completed. In about a month or so, the office and auxiliary buildings will also be finished. The machinery, Flinck system, has been imported from America, and the new factory is expected to be ready to put out plate glass from about January next. Late in August, Mr. Flinck investor of the Flinck system, is also expected at Dairen. Necessary gas service will be available at short notice. Two American engineers will aid in getting the glass works into running order and the output of the new factory is expected to be equal to that of any other country. Advance orders have been received from Shanghai, Tientsin, Harbin, and the South.

CHINCHOU MATCH-STICK FACTORY.—A new match-stick factory is being erected on a tract of land adjoining Chinchou station an hour from Dairen by rail. The first factory has five machines and work will be begun by operating three of them to a capacity of 25 carloads of match-sticks a month. This first plant is an experiment, and should the results be satisfactory, the scale of manufacture will be greatly enlarged. The promoters are Kobe capitalists.

PLAN FUSEL OIL PLANTS.—Methods for the recovery of fusel oil, chemically known as amyl alcohol, in the alcohol-distillation industry of the Philippines, have recently been developed by the bureau of science at low cost and it is expected that considerable expenditures for the necessary plant soon will be made. Fusel oil recovery is a new enterprise for the islands, although it has existed in other countries for some time, it was said. Fusel oil is a very useful and versatile substance and, because only a few tenths of one per cent. of the main product, alcohol are recovered, it is in great demand. The most important use is as a solvent for nitrocellulose in the manufacture of celluloid. It also is the starting point in the preparation of several artificial or "synthetic" perfumes and flavors, and in the manufacturs of patent leather for shoes. Large quantities are used in paints, varnishes, and lacquers, for special purposes such as the protection of metals from corrosion where a non-metallic coating is desired.

JAPAN'S AIRPLANE WORKS.—At present planes, motors, and accessories are made in one of the departments of the Kure naval munition factory, but in view of the enormous amount of work entailed by aerial preparedness, the authorities have decided to separate the plant, and erect an independent factory at Hiroshima, to employ 10,000 workers solely for manufacturing aeroplanes and parts thereof.

AIRPLANE FACTORY IN MANCHURIA.—The new airplane factory under management of a French expert, outside west gate, Mukden, is now being equipped. Airplane accessories beyond the scope of the new factory are to be imported direct from France to be assembled at Mukden. At present, one machine under re-erection. Marshal Chang Tso-lin is reported to be taking up manufacture of flying machines extensively though the present factory is on a modest scale and is the first plant of the kind in the three eastern provinces. A new hanger is under construction under east tower, outside east gate. At present, there are said to be over 70 airplanes in all Manchuria, including those that have not yet been assembled.

SHANGHAI SUGAR REFINERY.—The machinery of the China National Sugar Refinery Company, Ltd., a company organized in 1921, is being installed, and operations are expected to be started this autumn. One-fourth of the total capital of $10,000,000 has been paid up. Mr. M. Y. San is president and Mr. C. F. Yien, vice-president. The refinery, which is at Woosung near the Szetang River, is designed to melt 200 long tons of raw sugar a day. The raw materials will mainly be 96 degree raw sugar of which the largest part will be supplied by mills in Java and Kwangtung province. The machinery, which was ordered in November, 1922, is being supplied by the Grevenbroich Maschinenfabrik of Germany, and an agent of the company has come to China to supervise installation. China now imports from Hk. Tls. 30,000,000 to Hk. Tls. 50,000,000 worth of sugar yearly. The works of this Company will be the largest of the kind in China.

GLASS FACTORY FOR DAIREN.—Plate glass will be manufactured in Dairen by the South Manchuria Railway company in a new factory that will cover 20,000 *tsubo* to be completed glass making machinery is to be ordered from the United States.

NEW SUGAR CENTRAL FOR PHILIPPINES.—A new sugar central is in the process of organization in Capiz with construction expected to be completed in time to take care of next year's crop. M. Inglish, mechanical engineer of Negros, is in charge of the construction of the mill and installation of machinery.

MANUFACTURING

CAMPHOR REFINERY IN HONGKONG.—The camphor refinery belonging to Messrs. A. S. Watson & Co. (Ltd.), which was wrecked by the heavy typhoon on Aug. 18, is now rebuilt. The new plant, when in full operation, will have a capacity of approximately 10 tons of high-grade refined camphor per month. It is the intention to specialise on camphor in tablet form, the tablets to vary from one-eighth of an ounce to 2 ounces in weight, and the camphor will have a purity of from 99 to 99.5 per cent.

NEW PARAFFIN FACTORY FOR FUSHUN COLLIERIES.—An appropriation of Y.123,000 has been set apart in the estimates of the S.M.R. Co. for establishing a paraffin factory at the Fushun Collieries. The collieries have been carrying on the dry distillation of tar residues for obtaining heavy oil, gas. The new scheme above mentioned is to supply the company's own wants in paraffine, which have hitherto been procured from Japan.

JAPANESE CEMENT FOR JAVA.—The Onoda Cement Factory, Choushuitzu, now supplying 700,000 barrels of cement a year, has opened a business relation with Java through the Mitsui Bussan Kaisha and many thousands of barrels of Onoda cement already have been shipped. The cement is intended for road-building and construction of sugar refineries, etc., in Java.

RADIO

WIRELESS STATIONS FOR CHOSEN AND TAIWAN.—Chosen and other overseas possessions are still so poorly equipped with means of telegraphic communication, that the Japanese communications authorities have decided to construct two big powerful wireless stations solely devoted to communication with Chosen and Taiwan colonies, and have already started work on them. By the time they are completed, Chosen is expected to be in a position fully to carry on communication with the homeland through them. The wireless station at Ryuzan, however, is too old and too poorly equipped to serve such purpose. In view of this, the communications bureau in Chosen is considering measures to improve radio facilities. An official of the bureau has stated that the projected wireless stations, one at Kemigawa, Chiba prefecture, and the other at Iwatsuki, Saitama prefecture, now under construction, will be linked up with Chosen by a new Ryuzan station, estimated to cost Y.500,000 When the project is carried into effect, he says, it will be easy to handle more than 2,000 messages a day, thus greatly lessening the present congestion in telegraphic communication. To attain this by ordinary telegraphy, it would be necessary to lay new cables connecting Seoul and Tokyo at a cost of Y.1,700,000. In Taiwan it has already been decided to construct a powerful radio station at Keelung at a cost of Y.2,500,000, the example to be followed by Dairen at an early date.

RAILWAYS

SOUTH MANCHURIA RAILWAY ELECTRIFICATION.—A scheme to electrify the whole of south Manchuria is under contemplation by the South Manchuria Railway Company. Engineers investigating the source of the Yalu river have discovered, 100 miles north of Antung, a drop in the river from which, it is estimated, 100,000 kilowatts of electricity can be generated. The intention is not only to supply light, heat and power, including that to electrify the railway itself, but to use the power in the development of agriculture.

JAPAN ELECTRIFICATION WORK STARTS.—The ambitious plans of the imperial government railways of Japan for the substitution of electricity on the Tokaido railway line at the Kobe terminal has been started by the Kobe railway bureau. The entire line will be electrified by the end of 1928, according to present plans. The first phase of the work is the right-of-way between Maihara and Akashi. The second section to be electrified is the road between Maihara and Kyoto. These two sections will be completed by January 1, 1926. During the fiscal year 1924-25 it is planned to electrify the Tokaido from Tokio as far as Kozu, 50 miles to the southwest, and also the branch line to Yokosuka, the naval base on Tokio Bay. American equipment will be largely used in the electrification scheme.

The railway department has been negotiating with private interests for the purchase of a site for a power plant to furnish electricity for this section. When the Tokaido line is electrified the efficiency of the road will be raised 20 per cent., running speed will be greater and the overhead expenses will be reduced by 30 per cent.

TO OPEN LINE TO ATAMI.—Japanese railway experts believe they will be able to open the new railway line from Odawara to Atami next March. The line from there to Mishima, through the Tanna tunnel, will be completed in 1928. Twenty-five thousand six hundred feet or approximately half the length of the Tanna tunnel has been driven. Engineers are being hindered greatly by the seepage of water through rock cracks in the Tanna tunnel, but as soon as this is overcome with cement, the work will be easier and faster, say the expert.

PLAN LINE TO CHENGTU.—A plan is said to be afoot in the civil governor's office and the Szechuan railway and mine bureau for the construction of a railway between Chengtu and Chungking, a distance of about 900 *li*. Capital is to be raised privately among the people of the province. A petition for approval has been forwarded to the effect that authority is given for the construction of the proposed section, prior to which, however, plans in detail must be submitted for endorsement.

NEW TUNNEL SOON OPEN.—A government electric car service between Tokyo and Yokosuka via Ofuna will be inaugurated early next year. As a first step for electrifying the government railway services on the Tokaido and elsewhere, the department of railways has been cutting a tunnel between Ofuna and Hodogaya extending 48 chains which work is expected to be completed in September. The work was started in July, 1922, with Y.1,000,000. The new tunnel, when completed, will be the longest tunnel east of Hakone. Before the earthquake of September 1, the greater portion of the work was completed and not a single fissure was produced in the tunnel by the earthquake. At present, the finishing work such as the construction of arch, etc., is in progress.

KONGOSAN ELECTRIC RAILWAY.—Work on a section of eighteen miles between Tetsugen and Kinkwa on the Kongosan (Diamond Mountain) Electric Railway being finished, the section was opened to traffic on August 1, with rolling stock borrowed from the South Manchuria Railway. Work on the remainder of the 62 miles, connecting Tetsugen and Kwasen, is being steadily pushed on, the section between Tetsugen and Kinkwa, 14 miles long, being already completed. The Shibaura Works in Tokyo is speeding up the construction of the rolling stock for use on the railway but will be unable to complete it before September or October next.

LUNGHAI RAILWAY LOAN.—The *Chen Pao* says that the Lunghai Railway is to resume construction of the section between Sianfu and Lanchow and that a loan agreement has been signed by the ministry of communications and a group of Chinese banks, a Belgian bank participating because it held an option over this section. The loan is for $5,000,000, repayable in 10 years, the issue price 90, interest 8 per cent., and the security the revenues of the Lunghai Railway. The group includes the Bank of China at Chincheng and the salt industry at Chungnan.

The actual amount of the loan is Fcs. 75,000,000, which will be issued in Europe by the Banque Belge Pour Etranger to purchasing railway material, and also $10,000,000 to be issued in China to cover the cost of construction. The section of the railway to be constructed first is from Chengchow, Honan, to Sianfu. The agreement represents a modification of the old Belgian agreement of 1912, and the continuation of the line to Lanchowfu will be carried out later, while Dutch interests will complete a short section near Haichow—Extensions to Sianfu, the capital of Shensi.

HARBIN-TAHEIHO LINE.—Permission to build a railway between Harbin and Taheiho, a distance of 140 miles, has been obtained by a Russian named Skidelski, recommended by the *tuchun* of Heilungkiang, from Mr. Ma Chung-chun chief of the railway negotiation bureau, who has been in Harbin for some time past. The concession, which is said to have been signed in secret, reads as follows, according to an authentic source: (1) Mr. Skidelski shall manage the railway for 28 years after construction is complete. Thirty per cent. of the net profits shall be paid to the Heilungkiang government. (2) The railway shall be delivered over to the Chinese authorities at the end of 28 years, without indemnity. (3) The gauge of the proposed railway shall be five feet and one inch, the same as the Chinese Eastern Railway. (4) The capital shall be 20,000,000 yuan.

The Chinese chamber of commerce in Heilungkiang opposes the concession on the ground that while the first and second conditions are favorable to China, the third is contrary to the fundamental policy of the Chinese government to standardize the gauge of Chinese railways, and that all freight will be swallowed by Vladivostok when the Harbin-Taheiho railway is ready. The Chinese also claim that Russian influence will be paramount in Heilungkiang province and that the South Manchuria Railway Company will be affected owing to the difference in gauge. The actual cost of construction is estimated at $1,000,000. Consequently, the Chinese say half the capital and more, is to be spent in secret service money. It is surmised that the funds are to be raised in the United States.

PHILIPPINE R. CO., BUYS KOPPEL CARS.—The Koppel Industrial Car and Equipment Co. have been awarded an order for fifteen 30-ton double truck cane-cars by the Philippine Railway Company, Iloilo. These cars will be used for hauling sugar cane over the company's main lines to the Central Asturias.

CANTON-KOWLUNG RAILWAY.—The Central government has decided that the Canton-Kowlung railroad must be maintained at all costs, according to Peking despatches, and is ready to provide funds to keep it in condition. The ministry of communications, it is said, has asked Mr. Wen Teh-hua, director of the road, to come to Peking. He will be given $50,000 to maintain the road in addition to which the ministry will ask the Shanghai-Nanking line to donate $150,000 more.

JAPAN ELECTRIFIES LINES.—The department of railways is making plans for the electrification of four more lines, the Chuo, Ou, Hokuroku and Jyoetsu. All have numerous tunnels and sharp curves. The Chuo line, between Tokyo and Hachioji, runs more than 50 miles and has 40 tunnes which have impeded the efficiency of it. The electrification would be completed by 1929. Twenty-six miles of the Ou branch would be electrified, between Yonesawa and Fukushima, while on the Hokuroku line, the road between Maibara and Konjyo, a distance of 47 miles, would be improved. It is expected to cut the running time on the Hokuroku line by 40 per cent. Work on the electrification of the Tokaido line is progressing rapidly, the railway department reports. The section between Tokyo and Odawara probably will be completed by next June and the entire electrification by the end of 1929.

TAI-CHI RAILWAY LOAN.—A message is said to have been received in Peking from London approving the proposed contract for a loan by the Peking Syndicate on the Tai-Chi railroad. It is said that the loan contract prohibits the use of any of the funds for other than railroad construction purposes. The total amount of the loan, according to the Chinese papers, will be £1,500,000.

ANHWEI COAL LINE.—The Pu Yi Mining Co., Liehshan, Anhwei province, has petitioned the ministry of communications for the right to build a light railway to transport coal from Liehshan to Fulitsi, a distance of 13 miles, at the company's expense. An increase of capital, amounting to $900,000, is to be used for construction. The proposal is under consideration by the ministry.

TAONAN-KHINGAN RAILWAY.—Fengtien authorities together with the Mongolian princes are said to be planning the construction of a railway from Taonan to somewhere in the Khingan mountains in Eastern Mongolia. The line is to be known as the Taonan-Khingan Railway for construction of which $6,000,000 has been voted. Funds are to be raised in Fengtien, Kirin and Heilungkiang.

RAILWAY PLANNED NEAR PEKING.—The military authorities of Nanyuan, Peking, are asking the government for permission to construct a railway between Nanyuan and Hwangtsun near the capital. Work will be started as soon as approval is obtained from the ministries concerned.

SOUTH MANCHURIA RAILWAY.—At the 23rd meeting of shareholders of the South Manchuria Railway Co., held on June 21, the total capital of the company was reported to be Y.440,000,000, of which Y.380,000,000 is the present capital and Y.60,000,000 additional subscriptions still to be collected. The net profit for 1923 was Y.34,000,000, and a dividend and bonus amounting to 10 per cent. was declared.

CABLE ROAD UP FUJI.—Tokyo financiers are behind a movement to build a cable car railway up Mt. Fuji. The organization is to be called the Mt. Fuji Climbing Railway Company. It is to be capitalized for Y.1,000,000. Plans are to have the road built from the Yoshida entrance to the eighth station.

The promoters already have applied for permits the applications being on file at the department of home affairs and railways. Both departments have instructed the construction section of Yamanashi prefecture to make a survey of the mountain in connection with the project. A party of engineers, headed by Mr. Yoshida, will make an investigation.

TSOTSUYAO COLLIERY LINE.—The Tsotzuyao Colliery, near Wafangtien, Mr. H. Morita, manager, proposes to enlarge the scale of operation from next October to increase the annual outputs to above 70,000 tons. It is proposed to build a light railway line between the colliery and Wafangtien at a cost of Y.30,000. Some of the light rails between Changchun and Shihpeilin are to be taken over for use by the new line. Two engines and twenty-five ton goods cars, formally run on the Mukden-Antung light rail line, will serve as the initial rolling stock more to be purchased later.

RIVERS AND HARBORS

VLADIVOSTOK HARBOR.—The Ussuri Railway management has been carrying out several plans of improvement on the harbor facilities of Vladivostok since last winter, and now has a bean oil tank of 2,000 tons under construction, to be finished in August. The loading of bean oil into steamers in berth is being effected by means of pipes. The railway plans to construct waterworks, to supply shipping. Berthing sections not deep enough for large steamers, have been dredged, and much reclamation work has been done.

PORT ARTHUR HARBOR IMPROVEMENTS.—In view of the increase in South Manchuria exports in general and Fushun coal in particular, the South Manchuria Railway Company is planning to increase the capacity and shipping facilities of Port Arthur. Bridges, piers and jetties will be constructed. The total cost will be about Y.380,000, and the construction will probably be continued for four years.

SHIPPING

K. Y. K. TO HAVE NEW BOATS—The Kinkai Yusen Kaisha (Agents N.Y.K.), which was separated from N.Y.K. to develop the coasting service in April last year, has under construction two speedy ice-breakers at Yokohama to shorten the distance between Moji and Tientsin, and to continue winter navigation safety in the Gulf of Pechihli. One of these sister boats the *Nanrei Maru* having been completed, soon will be placed on the Tientsin run and will mark a new era in the traffic facilities in North China. She is over 2,000 tons gross, and develops a speed of 12 knots with a large reserve of power. Having been specially designed for this service, she is provided with electric fans, heating system, wireless apparatus, ice-breaking arrangement and all modern conveniences conducive to the safety and comfort of passengers and crew. The remarkable feature is that she has a 150 tons cold chamber on No. 3 deck so as to be able to carry fresh beef, fish, fruits, vegetables, etc., between Japan and Tientsin.

TO STABILIZE STEAMERS.—The department of railways will install stabilizers in its ferry-steamers between Shimonoseki and Fusan, Chosen. The three boats, the *Keifuku Maru*, the *Tokuju Maru*, and the *Seikei Maru*, advertised as the pride of the department, have become targets of criticism of late for their frequent inability to keep to their schedule. It is said that these boats cannot stand the rough voyage, due to their violent rolling. But with the opportunity offered by the repairing of the *Keifuku Maru* at the Mitsubishi Dock, the department decided to install a stabilizer in consideration of the successful result shown in an experiment on the *Mutsu Maru*, which demonstrated a surprising resistance against storm. The expense of a stabilizer is estimated at about 100,000 yen. This price is very much cheaper than the American stabilizer which costs a half million yen.

SOUTH MANCHURIA RAILROAD STEAMERS.—A plan for building two large passenger steamers to be placed on the regular Dairen-Shanghai service has been drafted by the South Manchuria Railway Company. Two modernly-equipped passenger steamers, each of 4,000 tons, are to be built according to the plan, and negotiations will be opened by the South Manchurian Company with the Mitsubishi shipbuilding yard, in Nagasaki, for the construction. Baron Kinmochi Okura, a director of the railway, has the matter in hand.

THE TAIKOO DOCKYARD AND ENGINEERING CO., LTD., is now building for the Hongkong, Canton and Macao Steamboat Co., Ltd., a big new river steamer to replace the *Heungshan* which struck a rock and was beached in Canton River. The new vessel will cost about $900,000 and will be about the same size and length as the *Lungshan* which was built for the same company at Kowloon Docks in October last. The vessel will be of a different type, especially so far as her engines are concerned, and will be a most up-to-date vessel in every respect. Her builders hope to be able to get from this new vessel a far higher speed than that of any other boat which the company owns. The order was secured by Taikoo in open tender with other firms.

SHU NAN CO., LTD.—The Shu Nan Steamship Navigation Co., Ltd., which has been promoted by Sun Tze-lin and others for the inauguration of another service on the Upper Yangtze, is now being organized. Capital is to be Tls. 50,000. It will have 12 motor boats sailing between Luchow, Kiating, Hsufu, Fushun and Chungking. The boats, which are to be ordered at Kiangnan Dockyard, will be 34-ft. long and 6-ft. wide with a displacement of 2-ft.

N.Y.K. TO IMPROVE SHIPS.—Special consideration is now being paid to the improvement of regular passenger liners by the Nippon Yusen Kaisha on its leading services such as the European, trans-Pacific, Seattle and Japan-China. A decision has recently been reached by the firm's directors to concentrate its available energy on the improvement of equipment for its large passenger steamers without paying attention to the declaration of high dividends, and that all available funds be employed as much as possible for this purpose.

To begin with, the Nippon Yusen will replace three steamers of the *Kitano Maru* class on the regular European lines, including the London and Liverpool services, by modernly equipped steamers of 14 knots speed. The *Kitano Maru* and two other steamers will be purchased by the Kinkai Yusen Kaisha to be placed on the Formosan service to rival the *Fuso Maru* and *Horai Maru,* newly placed by the Osaka Shosen Kaisha on its regular Formosan line.

On the completion of two 10,000-ton class freighters next autumn in Glasgow, which the firm ordered last year, the Nippon Yusen will place these new vessels on the trans-Pacific service. These new ships can develop a speed of 12 knots an hour as against the 10½ knots developed by the present freighters. The firm's Seattle service is now almost virtually suspended as the firm was outstripped in competition by American ships and the firm once decided to practically discontinue the service for good in anticipation of the prospective operation of Article 28 of the United States shipping law. Now that the Jones' act has been deferred, the firm will pay attention to the resumption of the service on a paying basis. Improvement will also be made on the Australian service and arrangement of ships to be alloted on it will be announced shortly, it is reported. The firm recently introduced a marked improvement on its Nagasaki-Shanghai regular passenger service and extended the base of operation to Kobe with Nagasaki and Moji as intermediate ports of call.—*Japan Advertiser.*

MITSUBISHI BUILDS STEAMER.—The Dairen Steamship Co., has ordered from the Mitsubishi Dockyard Co., a new 5,000 ton steamer of the *Shanghai Maru* type now on the Kobe Shanghai Line. The estimated cost is about Y.1,800,000. The steamer is to be completed by July, 1925.

TAIKOO LAUNCHES STEAMER.—The river steamer *Sai On,* built to the order of the Tung On Steamship Company, was launched at Taikoo Dockyard recently.

THE VESSEL.

The *Sai On* is a sister ship of the *s. Tung On,* launched last month, of which we gave full particulars at the time. She is a steel twin-screw river steamer, with an overall length of 233 feet, breadth 42 feet and moulded depth to main deck 12 feet. There is accommodation for thirty first-class passengers in beautifully appointed staterooms, and 68 open berths for second-class passengers.

The vessel is equipped with all the latest requirements for piracy prevention, including wireless telegraphy installed by the Marconi Company, this being the second river steamer to be so fitted, the other being her sister ship.

MITSUI BUILT MOTOR SHIP.—The first large Diesel motor ship to be built in Japan, under the direction of Japanese engineers and with Japanese labor, has been tested to the satisfaction of Lloyd's representative and has sailed for America. The vessel is one of the finest of the new additions to the mercantile navy of the Japanese empire. Turned out by the Mitsui Bussan Kaisha in their Tama shipbuilding yard located in the Inland Sea, the vessel is reported to have been built throughout of Japanese material, with the exception of the machinery which was supplied by Messrs. Burmeister and Main, Ltd. This motor ship has been christened the *Akagisan Maru.* It is a two-deck vessel, capable of making an average speed of 10 to 11 knots fully loaded. It has a deadweight tonnage of 7,100 tons; a gross tonnage of 4,630 tons; an overall length of 375 feet; a maximum breadth of 50 feet and a draught of 24 feet 3 inches. All the cargo hauling devices and other appliances are electrically worked, as are the windlass, the steering gear and the cooking apparatus. The hull was designed by the engineer in the employ of the Mitsuis and subsequent vessels of this nature are to be built in conformance with this design. The cargo handling is worked by several electric winches, is said to be 8,000 tons of 40 cubic feet.

A long-stroke type Diesel main engine, with six-cylinder, four-cycle, single-acting, forced-lubricated, cross-head, capable of developing 2,360 imperial horse-power forms the main propelling machinery. There are also three auxiliary Diesel engines, while the pumps are electrically worked. At the trials, an average speed of over 12 miles an hour was registered, while the consumption of oil was at the rate of about 7½ tons for a running period of 24 hours.

TELEGRAPHS AND RADIO

NEW PHILIPPINE PROJECTS.—Six important telegraph lines connecting Manila and rich agricultural regions and 12 more radio stations in Luzon, Visayan and Mindanao will be established by the bureau of posts next year, according to plans now being studied by the postal officials. Included in the proposed program is a cable line connecting Cebu and Iloilo, Superintendent Padua of the telegraph division reported. The six telegraph lines are: from Manila to Cagayan Valley along the new road; Ilocos to Cagayan province, passing the northern coast of Luzon; Laoag to Vigan; Negros Occidental to Negros Oriental; Mariveles to Limay, Bataan; and Dagupan to Lingayan.

The 12 proposed radio stations include one in Butuan which will connect Cebu and Surigao and another one in Borongan, Samar to improve the present service in the east coast of the island. The present line from Catbalogan to Borongan is always interrupted during the rainy season, it was reported.

TOKYO RADIO STATION.—A wireless station which has been under construction at the Tokyo Central Meteorological Observatory, is now completed and in operation. This station will co-operate with the marine observatory in Kobe in sending out correct time and weather report to steamers navigating on the open sea. The new wireless station also will be able to send weather reports to steamers off the coasts of Kurile islands and Hokkaido. The Kobe marine observatory has been sending weather reports to them in the past but the message often failed to be received accurately on account of the great distance.

TELEPHONES

HANKOW-LOYANG 'PHONE LINE.—Marshal Wu Pei-fu is hastening the construction of the long-distance telephone between Loyang and Hankow for military purposes, and work will start at once. According to Peking advices, it is learned that Messrs. Anderson, Meyer & Co. have secured the contract. While the exact estimate of the cost has not been stated, it is reported that the installation will involve several hundred thousand dollars. Mr. Yeh Kwei-hsin, who has been the superintendent of the Hankow telegraph administration, has been retained by Marshal Wu Pei-fu to take charge of the installation work, which, when completed, will be a great military convenience.

TRAMWAYS

ELECTRIC LINE TO ODAWARA.—Trains drawn by electric locomotives instead of the present steam engines will run between Tokyo and Odawara before the end of the present year. The electrification of the line had been long under consideration prior to the earthquake disaster and a sufficient number of cars were constructed to be used on the line, which, however, on account of destruction of so many cars, had to be used otherwise in place of those lost. Until sufficient new cars are constructed the plan is to use the present train equipment, but electric engines.

WATERWORKS AND IRRIGATION

HONGKONG WATERWORKS SCHEME.—Tenders are now being called for part of the first section of the Shing Mun waterworks scheme, namely, the north and south tunnels, the south conduit and contingent works. The official notice states that the work consists of driving and necessary lining of two tunnels, approximately 2,160-ft. and 4,680-ft. in length through smugglers' ridge and golden hill respectively, the construction of an open conduit approximately 2,000-ft. in length and contingent works.

TOKYO SEWER SYSTEM.—Tokyo will have one of the best sewer systems in the Orient when the present scheme of laying a ferro-concrete channel 18-ft. in diameter from Asakusa to the Rokugo river near Tsurumi between Tokyo and Yokohama, is completed in 1928, according to Mr. Z. Hara, chief of the Tokyo municipal sewer office. One thousand four hundred laborers are working daily, digging the ground to lay this gigantic channel. By next year the total number of laborers will be increased to 3,000, says Mr. Hara. The cost of the new sewer system will be Y.120,000,000. When the sewer reaches Rokugo river through this big channel it will be purified there and then allowed to flow into the sea. This will eliminate the drainage of the sewers into the Sumida river.

SEWAGE WORKS IN SEOUL.—Work on the projected sewage system in Seoul was started by the prefecture in the year 1918 and it was originally intended to complete the first stage this year at the estimated cost of Y.1,618,000, part of the money being defrayed from the national treasury and provincial estimates as aids, and the rest by the prefecture by means of loans. Increase in wages and rise in the price of materials have halted the work, leaving the part uncompleted for the second stage which will be started next year at the estimated cost of Y.1,400,000 spread over five consecutive years. On its completion Seoul will possess a complete sewage system. For Ryuzan the work is expected to be executed in the course of three years following at a cost of Y.420,000.

LIKAS DRAINAGE SCHEME.—The land owners at Likas, near Jesselton, British North Borneo, have agreed amongst themselves to pay a flat drainage rate upon their holdings. The drainage system taken over by the Likas board consists, at present, of an embankment along the sea beach with three self-operating sluice gates in it. These works were constructed in 1917 and 1918. Two or three miles of main drains take the water from 720 acres of coconuts and clear it through the gates at low tide. Mr. Bateson in 1917 wrote that the sluice gates must exclude sea water, must provide for drainage to an adequate depth, three feet being desirable, and must be large enough to take away flood water with reasonable rapidity. The three gates are still functioning well, but they require repairing and watching. At present one of the main drains is almost completely blocked by fallen timber caused by cattle trespass, so that the system is far from efficient. The agricultural department reported in 1922 and in 1923 that the coconuts were not doing at all well owing to stagnant water, but the department was of opinion that, if properly drained, the area would be good for coconut cultivation.

NEW WATERWORKS FOR CHINCHOU.—The railway town of Chinchou is to have its own waterworks, and work is to be started at once. The estimated cost of Y.80,000 is defrayed out of the local administration list. Of this sum Y.50,000 is to be laid out in the current fiscal year, the remaining Y.30,000 in the next fiscal year. A well, 30-ft. in diameter and 200-ft. deep, is to be sun kat North Sanlichuang 2½ miles northeast of the Chinese town of Chinchou. The well water is to be pumped up to a reservoir on the heights of Sanlichuang, to be distributed by iron pipes to both the Chinese and railway towns. The new waterworks will not only serve in sanitation but also may lead to the establishment of sundry industrial enterprises such as a new branch plant by the Naigai Raw Cotton Spinning Co., now under contemplation.